Hazard Mitigation Plan

Jasper County, Indiana

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Section 1 - Public Planning Process

1.1 Narrative Description

Hazard Mitigation is defined as any sustained action to reduce or eliminate long-term risk to human life and property from hazards. The Federal Emergency Management Agency (FEMA) has made reducing hazards one of its primary goals; hazard mitigation planning and the subsequent implementation of resulting projects, measures, and policies is a primary mechanism in achieving FEMA's goal.

The Multi-Hazard Mitigation Plan (MHMP) is a requirement of the Federal Disaster Mitigation Act of 2000 (DMA 2000). The development of a local government plan is a requirement in order to maintain eligibility for certain federal disaster assistance and hazard mitigation funding programs. In order for the National Flood Insurance Program (NFIP) communities to be eligible for future mitigation funds, they must adopt an MHMP.

The Jasper County Multi-Hazard Mitigation Planning Team was established in 2008 to define and prioritize the risks in the county and to develop a mitigation plan to minimize both the risks and the consequences of the defined hazards. KIRPC and Jasper County have joined efforts to develop this mitigation plan, realizing that the recognition of and the protection from hazards impacting the county and its residents contribute to future community and economic development. This team has worked closely on previous mitigation projects such as siren identification and location, area zoning considerations, identification and inventory of hazardous materials, and area training of response personnel. The team will continue to work together to develop and implement mitigation initiatives developed as part of this plan.

In recognition of the importance of planning in mitigation activities, the Federal Emergency Management Agency (FEMA) has created HAZUS-MH (**Haz**ards **US**A **M**ulti-**H**azard) a powerful geographic information system (GIS)-based disaster risk assessment tool. This tool enables communities of all sizes to predict the estimated losses from floods, hurricanes, earthquakes, and other related phenomena and to measure the impact of various mitigation practices that might help reduce those losses. The Indiana Department of Homeland Security has determined that HAZUS-MH should play a critical role in the risk assessments in Indiana. The Polis Center at Indiana University Purdue University Indianapolis (IUPUI) and the Indiana Geological Survey at Indiana University are assisting the Jasper County Multi-Hazard Mitigation Planning Team with performing the hazard risk assessment.

1.2 Planning Team Information

The Jasper County Multi-Hazard Mitigation Planning Team is composed of representatives from the four jurisdictions making up the county—Rensselaer, Wheatfield, DeMotte, and Remington. Members were selected based on their involvement with the various first response organizations in the county such as fire protection, law enforcement, government, and emergency management. The committee is comprised of at least 10 individuals, although other county representatives are encouraged to attend the risk assessment meetings as their schedules permit. Members of the committee were assigned to review of facilities in the county, past risks, and current and

potential risks. Based on these data, the committee is charged with developing plans to mitigate the potential consequences of the defined hazards.

The Jasper County MHMP team is headed by Karen Wilson, Emergency Management Director; Ed Gutwein, KIRPC, is the primary point of contact. Throughout the planning process, Ed conducted ancillary planning meetings for communities that were unable to attend the scheduled meetings. For example, he met with representatives of Demotte and Wheatfield to ensure that the towns had the opportunity to input mitigation strategies particular to their jurisdictions. Notes from Ed's meetings are included in Appendix A.

Members of the planning team include representatives from public health, law enforcement, government, EMA, the coroner's office, and fire protection. Table 1-1 identifies the planning team individuals and the organization they represent.

Table 1-1: Multi Hazard Mitigation Planning Team Members

Name	Title	Organization	Jurisdiction
Nancy Bailey	Public Health Nurse	Jasper County Health Department	Jasper County
Pat Berger	Council Member	Remington Town Council	Town of Remington
Brad Idlewine	Fire Chief	Remington Fire Department	Town of Remington
Thomas Jarrette		Demotte Police Department	Town of Demotte
Karen Wilson	Director	Emergency Management Agency	Jasper County
Orville Perry	Sheriff	Jasper County Sheriff's Department	Jasper County
Andy Boersma	Coroner	Boersma Funeral Home	Jasper County
Don Gear	Council Member	Wheatfield City Council	Town of Wheatfield
Ed Gutwein	Member	KIRPC	Jasper County
Edwin Buswell	Member	KIRPC	Jasper County
Randy Mitchell	Member	KIRPC	Jasper County
Alan Shanks	Director	GIS	Jasper County
Matthew A. Anderson		Rensselaer Police	Town of Rensselaer

The Disaster Mitigation Act (DMA) planning regulations and guidance stress that planning team members must be active participants. The Jasper County MHMP committee members were actively involved on the following components:

- Attending the MHMP meetings
- Providing available Geographic Information System (GIS) data and historical hazard information
- Reviewing and providing comments on the draft plans
- Coordinating and participating in the public input process
- Coordinating the formal adoption of the plan by the county

An MHMP kickoff meeting was held at Jasper County Courthouse on June 26, 2008. Representatives of Jasper County attended the meeting. John Buechler, GIS Manager, explained the rationale behind the MHMP program and answered questions from the participants. Mr. Buechler, from the Polis Center provided an overview of HAZUS-MH. Mr. Buechler went on to describe the timeline and the process of the mitigation planning project and presented Jasper County with a Memorandum of Understanding (MOU) for sharing data and information.

The Jasper County Multi-Hazard Mitigation Planning Committee met on June 26, 2008, August 21, 2008, October 9, 2008, and November 20, 2008. These meetings were held in the Jasper County Courthouse in Rensselaer, Indiana. Each meeting was approximately two hours in length. The meeting agendas, minutes, and attendance sheets are included in Appendix A. During these meetings, the planning team successfully identified critical facilities, reviewed hazard data and maps, identified and assessed the effectiveness of existing mitigation measures, established mitigation projects, , and assisted with preparation of the public participation information.

1.3 Public Involvement in Planning Process

An effort was made to solicit public input during the planning process, and a public meeting was held during the formation of the plan. The public hearing was held on November 20, 2008, after the committee reviewed the risk assessment. Appendix B contains articles published by the local newspaper throughout the public input process.

1.4 Neighboring Community Involvement

The Jasper County planning team invited participation from various representatives of county government, local city and town governments, community groups, local businesses, and universities. The team also held two meetings with adjacent counties to obtain their involvement in the planning process. Details of neighboring stakeholders' involvement are summarized in Table 1-2.

Table 1-2: Neighboring Community Participation

Person Participating	Neighboring Jurisdiction	Organization	Participation Description
Rose Brady	White County	White County Emergency Management Agency	Reviewed and commented on Section 3 of the plan.
Larry Hoover	Pulaski County	Pulaski County Emergency Management Agency	Neighboring county – reviewed plan and provided comments.
Ray Chambers	Newton County	Newton County Emergency Management Agency	Provided information regarding the location of proposed sites for new wells to meet growing demand for public water supply.
Randy Abbey	Starke County	Starke County Emergency Management Agency	Neighboring county – reviewed plan and provided comments.

1.5 Review of Technical and Fiscal Resources

The MHMP planning team has identified representatives from key agencies to assist in the planning process. Technical data, reports, and studies were obtained from these agencies. The organizations and their contributions are summarized in Table 1-3.

Table 1-3: Key Agency Resources Provided

Agency Name	Resources Provided
Indiana Department of Homeland Security	Provided repetitive loss information
Indiana Department of Natural Resources, Division of Water	Digital Flood maps and levee information
Indiana Geological Survey	GIS data, digital elevation models
FEMA	Earthquake liquefaction data

1.6 Review of Existing Plans

Jasper County and its associated local communities utilize a variety of planning documents to direct community development. These documents include land use plans, master plans, emergency response plans, municipal ordinances, and building codes. The MHMP planning process incorporated the existing natural hazard mitigation elements from these previous planning efforts. Table 1-4 lists the plans, studies, reports, and ordinances used in the development of the plan.

Table 1-4: Planning Documents Used for MHMP Planning Process

Author(s)	Year	Title	Description	Where Used
Indiana RPC 15	2003 – 2007	Comprehensive Economic Development Strategy (CEDS)	Lists economic and community projects for local governments. Includes mitigation to prevent developing in floodplain and building safer structures to withstand a potential earthquake.	Mitigation strategies from this plan were incorporated
Jasper County Advisory Plan Commission	2002 (Updated to April 23,2008)	Jasper County, Indiana Zoning Code	Comprehensive plan for land use, transportation, and public facilities.	Sections related to hazards incorporated into MHMP.
Town of Wheatfield	2008	Comprehensive Plan	Comprehensive plan for land use, transportation, and public facilities.	Sections related to hazards incorporated into MHMP.
Town of Wheatfield	1980 (updated in 2000)	Wheatfield Zoning Code and Subdivision Control Code	Document describes the zoning within the jurisdiction of the Town of Wheatfield.	The Pre-Disaster Mitigation Document and recent Comprehensive Plan recommend that more detailed zoning is necessary to minimize the damage of future events.
Jasper County	2003	Comprehensive Emergency Management Plan	Document describes types of potential hazards, agencies involved in the response to an emergency, and the organization that will respond in an emergency.	Sections related to hazards incorporated into MHMP.
Jasper County	2003	Jasper County Emergency Management Ordinance, # 3-3-2003A	Document describes the authorization and responsibilities of the Emergency Management Agency	Sections related to hazards incorporated into MHMP.

Author(s)	Year	Title	Description	Where Used
Jasper County	2003	Comprehensive Hazard Analysis	Identification of the hazards within Jasper County and documentation of past events	Section V lists the hazards occurring in Jasper County and the regulations impacting these hazards as well as the funding sources to mitigate damages.
Town of Remington	1994	Revised Zoning Code: Ordinance No. 5-2-94-1	Document describes the zoning within the jurisdiction of the Town of Remington.	Helped in the development of strategies associated with the flood hazard. Document used to define the flood plain, define regulations regarding the use of the flood plain, and requirements for controlling soil erosion and storm water drainage.
Town of Remington	1994	Comprehensive Plan Code: Resolution No. 5-2-94-1R	Comprehensive plan for land use, transportation, and public facilities	Helped in the development of strategies associated with the flood hazard. The Comprehensive Plan for Remington was developed for the promotion of public health, safety, morals, convenience, order or the general welfare, and for the sake of efficiency and economy in the process of development within the Remington jurisdiction.
Town of Remington	1994	Building Code: Ordinance No. 6-6-94-1	Document establishes the regulations regarding the placement and construction of buildings in the Remington jurisdiction.	On-going efforts of the Remington jurisdiction to incorporate requirements that help to minimize damage associated with potential hazards in future development.
Jasper County	1996	Drainage Study of Carpenter Creek Jasper County: Preliminary Investigation of Alternatives	This study came up with possible methods to lower the creek levels and provide erosion control and increase bank stability, which are technically, environmental, and socially feasible.	Study helped to define strategies for the Remington area and Carpenter Creek considering detention storage, channel improvements and clearing, and bridge widening to decrease the potential of flooding.

Section 2 - Jurisdiction Participation Information

The jurisdictions included in this multi-jurisdictional plan are listed in Table 2-1.

Table 2-1: Participating Jurisdictions

Jurisdiction Name
Town of Demotte
County of Jasper
Town of Remington
City of Rensselaer
Town of Wheatfield

2.1 Adoption by local governing body

The draft plan was made available on October 9, 2008 to the planning team and to the general public on November 20, 2008 for review. Comments were then accepted and incorporated into the plan. The Jasper County Hazard Mitigation Planning Team forwarded the draft plan to the Indiana Department of Homeland Security for presentation to FEMA. After considering the comments and recommendations from FEMA, the Jasper County Hazard Mitigation Planning team presented and recommended the plan to the Jasper County Commissioners, who adopted the Jasper County Hazard Mitigation Plan in July 2009 Resolution adoptions are included in Appendix C of this plan.

2.2 Jurisdiction Participation

It is required that each jurisdiction participates in the planning process. Table 2-2 lists each jurisdiction and how each participated in the construction of this plan.

Table 2-2: Jurisdiction Participation

Jurisdiction Name	Participating Member	Participation Description
Jasper County	Karen Wilson, EMA Director	Provided hazard specific information on fixed facilities located in Jasper County , Member, MHMP Planning Committee
Jasper County	Orville Perry, Sheriff	Reviewed plan and provided feedback
Jasper County	Nancy Bailey, Public Health Nurse	Review of Healthcare Facilities, Member, MHMP Planning Committee
Jasper County	Alan Shanks, GIS	Provided GIS data for hazard maps
City of Rensselaer	Matthew A. Anderson, Police	Member, MHMP Planning Committee
City of Remington	Pat Berger, Council Member	Reviewed draft plan and added information regarding ongoing projects in the Remington area, suggested mitigation strategies, and provided documents and pictures; Member, MHMP Planning Committee

Jurisdiction Name	Participating Member	Participation Description
Town of Wheatfield	Don Gear, Council Member	Member, MHMP Planning Committee; provided warming center data and back-up generator information for Wheatfield; defined ditches to the east and west of Wheatfield that require work to minimize flood damage
City of DeMotte	Thomas Jarrette, Demotte Police	Review of Water Facilities and Airports, Member, MHMP Planning Committee; defined housing in flood plains in Demotte that need to be purchased; defined ditches, roads, and culverts requiring re-design for flood control

All members of the MHMP planning committee were actively involved in attending the MHMP meetings, providing available Geographic Information System (GIS) data and historical hazard information, reviewing and providing comments on the draft plans, coordinating and participating in the public input process, and coordinating the county's formal adoption of the plan.

Because representatives from the Towns of Demotte and Wheatfield were unable to participate in some of the meetings, they gathered for an ancillary meeting on February 11, 2009. The team members discussed the draft plan and provided additional information and mitigation strategies, which have been incorporated in Section 5. Details of this meeting are included in Appendix A.

Section 3 - Jurisdiction Information

Jasper County was formed in 1838 and named after the famous continental scout William Jasper. The population is spread throughout 13 townships including Barkley, Carpenter, Gillam, Hanging Grove, Jordan, Kankakee, Keener, Marion, Milroy, Newton, Union, Walker, and Wheatfield. The county seat is Rensselaer.

As of 2007, Jasper County's population was recorded at 32,275 with a population density of 57.6 per square mile. There has been a steady population increase in the last few decades with a 21% increase from 1990 to 2000. The national average personal income in 2006 was $28,562 with a median household income of $48,016, while the state averages were $32,288 and $44,051, respectively. The average household size is 2.53, while the average family size is 3.05.

3.1 Topography

Jasper County is located in western Indiana and is bounded on the north by the Kankakee River, which separates it from Lake and Porter Counties. The east is bordered by Stark, Pulaski, and White, the south by White and Benton Counties, and the west by Newton County. The face of the county is generally level. The surface is covered with mostly dry and wet prairies, interspersed with small groves of timber, usually called barrens or oak openings. Much of the land is very fertile and well adapted to wheat, oats, corn, and grass.

Source: http://www.countyhistory.com/books/gazetteer/j.htm; http://www.censusfinder.com/mapin.htm

3.2 Climate

Jasper County has a typical climate for the Midwest. Temperatures fall below freezing in December and last through February. Based on National Climatic Data Center (NCDC), normals from 1971–2000, the lowest winter temperature is 14.4°F on average, and the average high is 30.4°F. During the summer, the average low is 63.5°F and the average high is 84.5°F. The average annual precipitation in Jasper County is 38.37 inches with an average of seven inches of snowfall from November through February.

Sources: RSS Weather 2003-2007: http://www.rssweather.com/climate/Indiana/Indianapolis; NCDC website, 1971-2000 Climate Normals: http://hurricane.ncdc.noaa.gov/cgi-bin/climatenormals/climatenormals.pl?directive=prod_select2&prodtype=CLIM81&subrnum;
NOAA website, Indianapolis Climatological Information: http://www.crh.noaa.gov/ind/local_cli.php#day

3.3 Demographics

Jasper County has a population of 32,275. According to STATS Indiana, from 2000–2004, Jasper County experienced a population increase of 30%. The largest town in Jasper County is Rensselaer which has a population of approximately 6,259.

The breakdown of population by incorporated areas is included in Table 3-1.

Table 3-1: Population by Community

Community	2006 Population	% of County
Demotte	4013	12.6
Remington	1266	4
Rensselaer	6259	19.7
Wheatfield	855	2.8

Source: STATS Indiana, 2006

3.4 Economy

STATS Indiana reported for 2006 that 83.5% of the workforce in Jasper County was employed in the private sector. The breakdown is included in Table 3-2. Retail represents the largest sector, employing approximately 95% of the workforce and generating approximately 96.9% of the earnings. The 2006 annual per capita income in Jasper County is $28,562 compared to an Indiana average of $32,288.

Table 3-2: Industrial Employment by Sector

Industrial Sector	% of County Workforce (2006)
Agriculture, forestry, fishing, hunting, and mining	N/A
Construction	10.5%
Manufacturing	9.4%
Wholesale trade	N/A
Retail trade	12.2%
Transportation, warehousing and utilities	7%
Information	7.4%
Finance, insurance, real estate, and rental/leasing	2.9%
Waste management services	3.3%
Educational, health, and social services	6.4%
Arts, entertainment, recreation, accommodation and food services	.9%
Other services(except public administration)	5.7%
Public administration	4%

Source: STATS Indiana, 2006

3.5 Industry

Jasper County's major employers and number of employees are listed in Table 3-3. The largest manufacturing employer is Sealy Components, Inc, which has nearly 275 employees. Talbert Manufacturing (produces specialty truck trailers with major contracts with the Federal Government) is the second largest with 200 full-time employees. Several non-manufacturing industries employ larger numbers of employees. These industries include two school corporations, the county hospital, and a building construction business in Remington.

Table 3-3: Major Employers

Manufacturing				
Company Name	**Location**	**Established**	**Employees**	**Type of Business**
Sealy Components, Inc.	Rensselaer		275	Mattress Components
Talbert Manufacturing	Rensselaer		200	Specialty Truck Trailers
ConAgra Foods	Rensselaer		229	Popcorn Snacks/Packaging
Omni Forge, Inc.	Remington	1990	144	Carbon Alloy Forming
Donaldson Company	Rensselaer		139	Distribution Center
Chief Industries	Rensselaer		156	Steel Buildings
Georgia-Pacific	Wheatfield		103	Gypsum Wallboard
Rensselaer Plastics	Rensselaer		60	PVC Pipe and Gutters
Windy Ridge Dairy	Fair Oaks		88	Dairy
Solae LLC	Remington		65	Soy Protein Products
Stark Truss Company	Rensselaer		60	Truss and Wall Sections
National Gypsum Company	Rensselaer		42	Joint Tape and Compound
Tefft Bridge and Iron	Tefft		47	Metal Fabrication
Industrial Pallet	Remington		35	Wooden Pallets
Iroquois Bio-Energy	Rensselaer	2007	33	Ethanol
Murpac	Remington		23	Spool Refurbishing

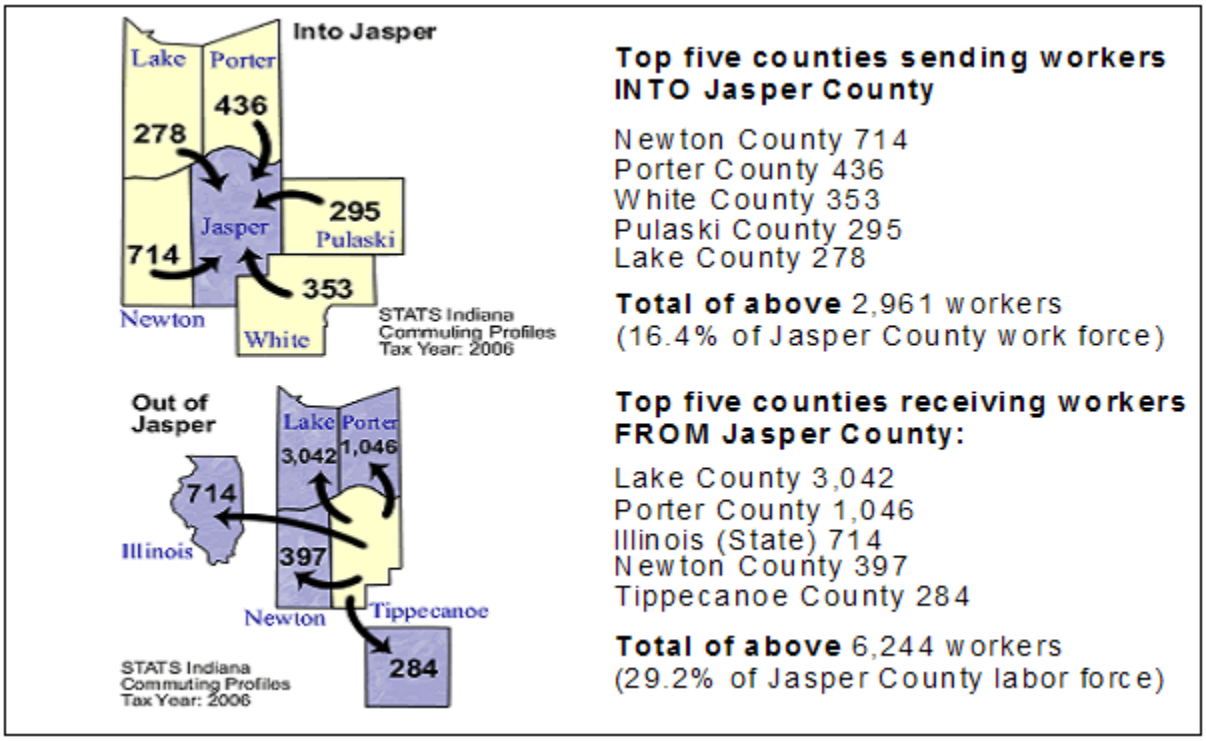
Non-Manufacturing Employers				
Kankakee Valley School Corp.	Wheatfield		500	School
Jasper County Hospital	Rensselaer		457	Hospital
FBI Buildings, INC.	Remington	1958	356	Building Construction
Rensselaer Central School Corp.	Rensselaer		278	School
NIPSCO Generating Station	Wheatfield		263	Utility
Schilli Transportation	Remington		220	Transportation
St. Joseph's College	Rensselaer		200	Education
Jasper County Government	Rensselaer		175	Government
Rensselaer Care Center	Rensselaer		152	Long-term Care Services
AgroKey, LLC	Rensselaer		115	Agricultural Services

Source: Jasper County Chamber of Commerce, 2006

Commuter Patterns

According to STATS Indiana information from 2006, Jasper County has approximately 15,457 residents who are in the work force. Of these, approximately 9,200 work in the county. Roughly 6,200 residents commute outside the county for work and 2,900 non-residents commute into the county to work. Figure 3-1 depicts the commuting patterns into and out of the top five surrounding jurisdictions.

Figure 3-1: Commuter patterns into and out of Jasper County



Source: STATS Indiana, 2006

3.6 Land Uses and Development Trends

Agriculture is the predominant land use in Jasper County. Corn is the primary crop, followed by soybeans, winter wheat, hay, and oats. Other significant land uses are industrial and residential. With Interstate 65 cutting through Jasper County, areas around this highway are potential growth areas for various businesses.

3.7 Major Lakes, Rivers, and Watersheds

Jasper County is bordered to the north by the Kankakee River; however, there are no significant lakes. The county crosses three HUC08 watersheds: Kankakee, Tippecanoe, and Iroquois. A list of 14-digit Hydrologic Unit Code (HUC) watersheds is included in Table 3-4.

Table 3-4: Watersheds

HUC Code	Watershed Name
07120002030030	Keefe Ditch
05120106120050	Hollingsworth Ditch
05120106120060	Hoagland Ditch-Winters Ditch
07120001110040	Moffitt Ditch
07120001090090	Crooked Creek-Hannon Ditch
07120001120010	Mud Lake Ditch-Gregory Ditch
07120002030060	Carpenter Creek-Headwaters
07120002030070	Carpenter Creek-Claude May Ditch/Egypt
07120002030040	Bice Ditch-Nesius Ditch
07120001090150	Cobb Creek-Breyfogel Ditch
07120002040050	Gushwa Ditch-Hunter Ditch
07120001090040	Reeves Ditch
07120002020010	Iroquois River-Headwaters
07120002010030	Oliver Ditch-Griggs/Callahan/Folger Ditches
07120001100020	Wolf Creek-Hickam Lateral
07120001080090	Kankakee River-Lawton/Davis Ditches
07120001100030	Hodge Ditch-Delehanty/Schatley Ditches
07120002040090	Hunter Ditch
07120002030010	Slough Creek-Spurgeon Ditch
07120002010020	Oliver Ditch-Lateral # 77 Ditch
07120002030080	Slough Creek-Carpenter Creek (lower)
07120002030050	Slough Creek-Bice Ditch (lower)
07120002030020	Slough Creek-Jordan Ditch
07120002040060	Mosquito Creek-Simonin Ditch
07120001090140	Phillips Ditch-Cornell Ditch
07120001100010	Wolf Creek-Headwaters
05120106110130	Big Monon Creek-Brown Ditch
07120002040040	Iroquois River-Turner Ditch
07120002020050	Ryan Ditch-Smallfelt Ditch
05120106120010	McKillip Ditch-McKillip Branch Ditch
07120001100040	Hodge Ditch-Cook Ditch
05120106110120	Hill Ditch
07120002020040	Ryan Ditch Cutoff
07120002020030	Iroquois River-Bruner Ditch
07120001110020	Kankakee River-Brown Levee Ditch
07120001110010	Dehaan Ditch
05120106110100	Big Monon Ditch-Pelsey Ditch
05120106110090	Mosley Ditch-Mosley Branch
07120001090130	Sandy Hook Ditch/Benkie Ditch-Kouts
07120002020020	Iroquois River-Dexter Ditch
05120106110060	Antrim Ditch-Stump Ditch
07120001080080	Cook Ditch
05120106120020	McKillip Ditch-Kesler Ditch
07120002020060	Iroquois River-North Marion
07120001080070	Kankakee River-Payne/Rassmussen Ditches

HUC Code	Watershed Name
07120002040030	Iroquois River-Curtis Creek-Yeoman Ditch
07120002010010	Oliver Ditch-Ringneck Lake
07120002040010	Curtis Creek-Headwaters
07120002040020	Curtis Creek-Long Ditch (Mount Ayr)

Sources: U.S. Geological Survey HUC14 Watersheds, 2006.

U.S. EPA: http://cfpub.epa.gov/surf/county.cfm?fips_code=18073

Section 4 - Risk Assessment

The goal of mitigation is to reduce the future impacts of a hazard including property damage, disruption to local and regional economies, and the amount of public and private funds spent to assist with recovery. However, mitigation should be based on risk assessment. A risk assessment involves measuring the potential loss from a hazard event by assessing the vulnerability of buildings, infrastructure, and people. It identifies the characteristics and potential consequences of hazards, how much of the community could be affected by the hazard, and the impact on community assets. A risk assessment consists of three components—hazard identification, vulnerability analysis, and risk analysis.

Hazard Identification

4.1.1 Existing Plans

To facilitate the planning process, pre-existing plans were used for this risk assessment section. These existing plans included the Jasper County Comprehensive Emergency Management Plan November 2003, Indiana digital flood maps, and the Drainage Study of Carpenter Creek, Jasper County Indiana, Preliminary Investigation of Alternatives, 1996.

4.1.2 Planning Team

Previous planning efforts associated with the development of the 2003 Jasper County Comprehensive Emergency Management Plan (CEMP) identified the principle natural hazards to Jasper County (in order of likelihood): 1) flooding from severe storms and spring rains; 2) severe winds associated with thunderstorms; 3) severe winter weather, including snowstorms and ice storms; 4) tornadoes; and 5) earthquakes.

The plan also identified Jasper County's principal technological hazards (in order of likelihood): 1) structural fires; 2) hazardous materials events (fixed-sites and transportation-related); 3) infrastructure failures; 4) wildfires; and 5) transportation accidents.

During Meeting #2, which occurred on August 21, 2008, the planning team developed and ranked a list of hazards it felt affected the jurisdiction. The team identified flooding, winter storms, windstorms and wildfires as the four most significant hazards.

4.1.3 National Hazard Records

In addition to these identified hazards, the MHMP planning committee reviewed the list of natural hazards prepared by FEMA. To assist the planning team, historical storm event data was compiled from the National Climatic Data Center (NCDC) http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll.

NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and

may not match the final assessment of economic and property losses related to a given weather events.

The NCDC data included 153 reported events in Jasper County between December 2, 1950 and April 2, 2008. A summary table of events related to each hazard type is included in the hazard profile sections that follow. A full table listing all events, including additional details, is included as Appendix D. In addition to NCDC data, Storm Prediction Center (SPC) data associated with tornadoes, strong winds, and hail were plotted using SPC recorded latitude and longitude. These events are plotted and included as Appendix E. NCDC hazards are included in Table 4-1.

Table 4-1: Climatic Data Center Historical Hazards

Hazard
Tornadoes
Severe Thunderstorms
Drought/Extreme Heat
Winter Storms
Flood/Flash flood

4.1.4 Hazard Ranking Methodology

Based on planning team input, national datasets, and existing plans Table 4-2 lists the hazards Jasper County will address in this all hazards mitigation plan. In addition, these hazards ranked the highest based on the Priority Risk Index discussed in section 4.1.5.

Table 4-2: Planning Team Hazard List

Hazard
Flooding/Dam Failure
Tornado
Hazardous Materials Release
Thunderstorms/High Winds/Hail/Lightning
Drought/Extreme Heat
Earthquake
Severe Winter Storms
Explosion/Fire

4.1.5 Priority Risk Index

The next step involved a vulnerability analysis in which each hazard was assigned a likelihood rating based on the criteria and methods described in the following table. Table 4-3 displays the probability of the future occurrence ranking. This ranking was based upon previous history and the definition of hazard. Using the definitions given, the likelihood of future events is "Quantified" which results in the classification within one of the four "Ranges" of likelihood.

Table 4-3: Future Occurrence Ranking

Probability	Characteristics
4 - *Highly Likely*	Event is probable within the calendar year. Event has up to one in one year chance of occurring. (1/1=100%) History of events is greater than 33% likely per year.
3 - *Likely*	Event is probable within the next three years. Event has up to one in three years chance of occurring. (1/3=33%) History of events is greater than 20% but less than or equal to 33% likely per year.
2 - *Possible*	Event is probable within the next five years. Event has up to one in five years chance of occurring. (1/5=20%) History of events is greater than 10% but less than or equal to 20% likely per year.
1 - *Unlikely*	Event is possible within the next ten years. Event has up to one in ten years chance of occurring. (1/10=10%) History of events is less than or equal to 10% likely per year.

Next, the magnitude of the hazard's effect is considered according to the severity associated with past events of the hazard. Table 4-4 gives four classifications of Magnitude/Severity.

Table 4-4: Hazard Magnitude

Magnitude/Severity	Characteristics
4 - *Catastrophic*	Multiple deaths. Complete shutdown of facilities for 30 or more days. More than 50% of property is severely damaged.
3 - *Critical*	Injuries and/or illnesses result in permanent disability. Complete shutdown of critical facilities for at least 14 days. More than 25% of property is severely damaged.
2 - *Limited*	Injuries and/or illnesses do not result in permanent disability. Complete shutdown of critical facilities for more than seven days. More than 10% of property is severely damaged.
1 - *Negligible*	Injuries and/or illnesses are treatable with first aid. Minor quality of life lost. Shutdown of critical facilities and services for 24 hours or less. Less than 10% of property is severely damaged.

Warning Time and Duration are allotted four ranges each, as shown in the Table 4-5. Also indicated is the weighting factor for each of the four parts of the Calculated Priority Risk Index. The Probability factor is weighted at .45, Magnitude/Severity at .30, Warning Time at .15, and Duration at .10. These weights of significance are used to assign relative importance to each of these factors when combined to generate the Calculated Priority Risk Index value.

Table 4-5: Calculated Priority Risk Index

.45 Probability	.30 Magnitude/Severity	.15 Warning Time	.10 Duration
4 - Highly Likely	4 - Catastrophic	4 - Less Than 6 Hours	4 - More Than 1 Week
3 - Likely	3 - Critical	3 - 6-12 Hours	3 - Less Than 1 Week
2 - Possible	2 - Limited	2 - 12-24 Hours	2 - Less Than 1 Day
1 - Unlikely	1 - Negligible	1 - 24+ Hours	1 - Less Than 6 Hours

Table 4-6 identifies the Calculated Priority Risk Index for each hazard facing Jasper County.

Table 4-6: Jasper County Hazards (Calculated Priority Risk Index)

Hazard	Probability	Magnitude/ Severity	Warning Time	Duration	Priority Risk Index
Flooding	**4** *Highly Likely*	**2** *Limited*	**3** *6-12 Hours*	**3** *Less Than 1 Week*	3.15
Tornado	**4** *Highly Likely*	**2** *Limited*	**4** *<6 Hours*	**1** *Less Than 6 Hours*	3.1
Thunderstorms/ High Winds/Hail/ Lightning	**4** *Highly Likely*	**2** *Limited*	**4** *<6 Hours*	**1** *Less Than 6 Hours*	3.1
Winter Storms	**4** *Highly Likely*	**1** *Negligible*	**3** *6-12 Hours*	**3** *Less Than 1 Week*	2.85
Transportation Hazardous Material Release	**3** *Likely*	**2** *Limited*	**4** *<6 Hours*	**2** *Less Than 1 Day*	2.75
Earthquake	**2** *Possible*	**2** *Limited*	**4** *<6 Hours*	**2** *Less Than 1 Day*	2.3
Droughts/ Extreme Heat	**2** *Possible*	**2** *Limited*	**1** *24+ hours*	**4** *More Than 1 Week*	2.05
Fire/Wildfire	**2** *Possible*	**1** *Negligible*	**4** *<6 Hours*	**1** *Less Than 6 Hours*	1.9

4.1.6 GIS and HAZUS-MH

The third step is the risk analysis which quantifies the risk to the population, infrastructure, and economy of the community. Where possible, the hazards were quantified using Geographic Information System (GIS) analyses and HAZUS-MH, a GIS-based risk mitigation tool developed by the Federal Emergency Management Agency (FEMA). This process reflects a level two approach to analyzing hazards as defined for HAZUS-MH. The approach includes substitution of selected default data with local data. This process improved the accuracy of the model predictions.

HAZUS-MH generates a combination of site-specific and aggregated loss estimates depending upon the analysis options that are selected and upon the input that is provided by the user. Aggregate inventory loss estimates, which include building stock analysis, are based upon the assumption that building stock is evenly distributed across census blocks/tracts. Therefore, it is possible that overestimates of damage will occur in some areas while underestimates will occur in other areas. With this in mind, total losses tend to be more reliable over larger geographic areas than for individual census blocks/tracts. It is important to note that HAZUS-MH is not intended to be a substitute for detailed engineering studies. Rather, it is intended to serve as a planning aid for communities interested in assessing their risk to flood-, earthquake-, and hurricane-related hazards. This documentation does not provide full details on the processes and procedures completed in the development of this project. It is only intended to highlight the major steps that were followed during the project.

Site-specific analysis is based upon loss estimations for individual structures. For flooding, analysis of site-specific structures takes into account the depth of water in relation to the structure. HAZUS-MH also takes into account the actual dollar exposure to the structure for the costs of building reconstruction, content, and inventory. However, damages are based upon the assumption that each structure will fall into a structural class, and structures in each class will

respond in a similar fashion to a specific depth of flooding or ground shaking. Site-specific analysis is also based upon a point location rather than a polygon, therefore the model does not account for the percentage of a building that is inundated. These assumptions suggest that the loss estimates for site-specific structures as well as for aggregate structural losses need to be viewed as approximations of losses that are subject to considerable variability rather than as exact engineering estimates of losses to individual structures.

The following events were analyzed. The parameters for these scenarios were created though GIS, HAZUS-MH, and historical information to predict which communities would be at risk.

Using HAZUS-MH

1. 100-year overbank flooding
2. Earthquake scenarios

Using GIS

1. Tornado
2. Hazardous material release

Vulnerability Assessment

Asset Inventory

Processes and Sources for Identifying Assets

The HAZUS-MH data is based on best available national data sources. The initial step involved updating the default HAZUS-MH data using State of Indiana data sources. At Meeting #2 the planning team members were provided with a plot and report of all HAZUS-MH critical facilities. The planning team took GIS data provided by The Polis Center; verified the datasets using local knowledge, and allowed The Polis Center to use their local GIS data for additional verification. Polis GIS analysts made these updates and corrections to the HAZUS-MH data tables prior to performing the risk assessment. These changes to the HAZUS-MH inventory reflect a level two analysis. This update process improved the accuracy of the model predictions.

The default HAZUS-MH data has been updated as follows:

- The HAZUS-MH defaults, critical facilities, and essential facilities have been updated based on the most recent available data sources. Critical and essential point facilities have been reviewed, revised, and approved by local subject matter experts at each county.
- The essential facility updates (schools, medical care facilities, fire stations, police stations, and EOCs) have been applied to the HAZUS-MH model data. HAZUS-MH reports of essential facility losses reflect updated data.

The default aggregate building inventory tables have been replaced with the most recent Assessor records. Jasper County provided the parcel boundaries to The Polis Center, and Indiana Department of Local Government and Finance provided the Jasper County Assessor records. Records without improvements were deleted. The parcel boundaries were converted to parcel

points located in the centroids of each parcel boundary. Each parcel point was linked to an Assessor record based upon matching parcel numbers. The generated GBS points represent the approximate locations (within a parcel) of building exposure. The parcel points were aggregated by census block. Parcel-matching results for Jasper County are listed in Table 4-7.

Table 4-7: Parcel-Matching for Jasper County

Data Source	Count
Assessor Records	18,918
County Provided Parcels	20,594
Assessor Records with Improvements	12,241
Matched Parcel Points	12,071

The following assumptions were made during the analysis:

- The building exposure is determined from the Assessor records. It is assumed that the population and the buildings are located at the centroid of the parcel.
- The algorithm used to match county-provided parcel point locations with the Assessor records is not perfect. The results in this analysis reflect matched parcel records only. The parcel-matching results are included in Table 4-7.
- GBS points are used for the flood, tornado and hazmat overlay analysis.
- Population counts are based upon 2.5 persons per household. Only residential occupancy classes are used to determine the impact on the local population. If the event were to occur at night, it would be assumed that people are at home (not school, work, or church).
- The analysis is restricted to the county boundaries. Events that occur near the county boundaries do not contain damage assessments from adjacent counties.

Essential Facilities List

Table 4-8 identifies the essential facilities that were added or updated for the analysis. Essential facilities are a subset of critical facilities. A complete list of critical facilities is included as Appendix F. A map of all critical facilities is included as Appendix G.

Table 4-8: Essential Facilities List

Facility	Number of Facilities
Care Facilities	5
Emergency Centers	1
Fire Stations	4
Police Stations	5
Schools	16

Facility Replacement Costs

Facility replacement costs and total building exposure are identified in Table 4-9. The replacement costs have been updated with local assessor data. Table 4-9 also includes the estimated number of buildings within each occupancy class.

The Assessor records often do not distinguish parcels by occupancy class when the parcels are not taxable; therefore, the total number of buildings and the building replacement costs for government, religious/non-profit, and education may be underestimated.

Table 4-9: Building Exposure

General Occupancy	Estimated Total Buildings	Total Building Exposure (X 1000)
Agricultural	1624	$243,372
Commercial	582	$243,307
Education	2	$808
Government	3	$1,651
Industrial	187	$133,261
Religious/Non-Profit	4	$2,636
Residential	10,422	$1,124,850
Total	**12,824**	**$1,749,885**

4.3 Future Development

In the Jasper County Comprehensive Emergency Management Plan (November 2003), Section V (Concepts of Operation), the Board of Commissioners have directed each county agency, or department with emergency or disaster responsibilities, along with local jurisdictions, to have multi-hazard emergency plans and implementation procedures. The revised Jasper County Zoning Code (updated to April, 2008) controls construction of permanent structures in flood plains, requires manufactured housing to be tied down, and identifies hazardous operations and materials with regard to the safety of the population. These documents plus the impact of this pre-disaster hazard mitigation plan on both these documents and others dealing with land use and jurisdictional comprehensive plans will focus on options that limit future damages from identified natural and man-made hazards.

4.4 Hazard Profile

4.4.1 Tornado Hazard

Hazard Definition for Tornado Hazard

Tornadoes pose a great risk to the State of Indiana and its citizens. Tornadoes can occur at any time during the day or night. They can also happen during any month of the year. The unpredictability of tornadoes makes them one of Indiana's most dangerous hazards. Their extreme winds are violently destructive when they touch down in the region's developed and populated areas. Current estimates place the maximum velocity at about 300 mph, but higher and lower values can occur. A wind velocity of 200 mph will result in a wind pressure of 102.4 pounds per square foot of surface area—a load that exceeds the tolerance limits of most buildings. Considering these factors, it is easy to understand why tornadoes can be so devastating for the communities they hit.

Tornadoes are defined as violently-rotating columns of air extending from thunderstorms to the ground. Funnel clouds are rotating columns of air not in contact with the ground; however, the violently-rotating column of air can reach the ground very quickly and become a tornado. If the funnel cloud picks up and blows debris, it has reached the ground and is a tornado.

Tornadoes are classified according to the Fujita tornado intensity scale. The tornado scale ranges from low intensity F0 with effective wind speeds of 40 to 70 mph to F5 tornadoes with effective wind speeds of over 260 mph. The Fujita intensity scale is included in Table 4-10.

Table 4-10: Fujita Tornado Rating

Fujita Number	Estimated Wind Speed	Path Width	Path Length	Description of Destruction
0 (Gale)	40–72 mph	6–17 yards	0.3–0.9 miles	Light damage, some damage to chimneys, branches broken, sign boards damaged, shallow-rooted trees blown over.
1 (Moderate)	73–112 mph	18–55 yards	1.0–3.1 miles	Moderate damage, roof surfaces peeled off, mobile homes pushed off foundations, attached garages damaged.
2 (Significant)	113–157 mph	56–175 yards	3.2–9.9 miles	Considerable damage, entire roofs torn from frame houses, mobile homes demolished, boxcars pushed over, large trees snapped or uprooted.
3 (Severe)	158–206 mph	176–566 yards	10–31 miles	Severe damage, walls torn from well-constructed houses, trains overturned, most trees in forests uprooted, heavy cars thrown about.
4 (Devastating)	207–260 mph	0.3–0.9 miles	32–99 miles	Complete damage, well-constructed houses leveled, structures with weak foundations blown off for some distance, large missiles generated.
5 (Incredible)	261–318 mph	1.0–3.1 miles	100–315 miles	Foundations swept clean, automobiles become missiles and thrown for 100 yards or more, steel-reinforced concrete structures badly damaged.

Previous Occurrences for Tornado Hazard

There have been several occurrences of tornadoes within Jasper County during the past few decades. The National Climatic Data Center (NCDC) database reported 19 tornadoes/funnel clouds in Jasper County since 1950. On July 10, 2001, one tornado touched down destroying a garage and damaging the corner of the roof of a barn. The tornado continued through corn and bean fields and exited Jasper County 12 miles east of Rensselaer, moving into Pulaski County. *Source: NCDC*

The Jasper County NCDC recorded tornadoes are identified in Table 4-11. Additional details for NCDC events are included in Appendix D.

Table 4-11: Jasper County Tornadoes*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Jasper	6/14/1954	Tornado	F	0	0	0K	0
Jasper	6/19/1954	Tornado	F0	0	0	0K	0
Jasper	5/21/1956	Tornado	F1	0	0	3K	0
Jasper	4/26/1957	Tornado	F1	0	0	3K	0
Jasper	6/8/1958	Tornado	F1	0	0	25K	0
Jasper	6/8/1958	Tornado	F2	0	0	25K	0
Jasper	4/30/1962	Tornado	F2	0	0	250K	0
Jasper	4/17/1963	Tornado	F4	0	16	2.5M	0
Jasper	12/8/1966	Tornado	F2	0	1	25K	0
Jasper	9/26/1967	Tornado	F2	0	1	25K	0
Jasper	6/23/1968	Tornado	F0	0	0	0K	0
Jasper	6/17/1975	Tornado	F1	0	0	250K	0
Jasper	3/12/1976	Tornado	F3	1	8	250K	0
Jasper	3/12/1976	Tornado	F3	0	0	0K	0
Jasper	3/12/1976	Tornado	F1	0	0	25K	0
Jasper	5/4/1977	Tornado	F1	0	0	25K	0
Jasper	6/8/1981	Tornado	F1	0	0	250K	0
Rensselaer	7/10/2001	Tornado	F0	0	0	10K	0
Rensselaer	5/9/2004	Tornado	F0	0	0	0	0

* NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

Geographic Location for Tornado Hazard

The entire county has the same risk for occurrence of tornadoes. They can occur at any location within the county.

Hazard Extent for Tornado Hazard

The historical tornadoes listed in Table 4-11 generally move from southwest to northeast across the county. The extent of the hazard varies both in terms of the extent of the path and the wind speed.

Calculated Priority Risk Index for Tornado Hazard

Based on historical information, the probability of a tornado is highly likely. Tornadoes with varying magnitudes are expected to happen. According to the CPRI, tornadoes ranked as the number two hazard, along with thunderstorm/wind/hail/lightning storms.

CPRI = Probability X .45 + Magnitude/Severity X .30 + Warning Time X .15 + Duration of event X .10.

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
4 x .45	+	**2** x .30	+	**4** x .15	+	**1** x .10	=	**3.1**

Vulnerability Analysis for Tornado Hazard

Tornadoes can occur within any area in the county; therefore, the entire county population and all buildings are vulnerable to tornadoes and can expect the same impacts within the affected area. To accommodate this risk, this plan will consider all buildings located within the county as vulnerable.

Critical Facilities

All critical facilities are vulnerable to tornadoes. A critical facility will encounter many of the same impacts as any other building within the jurisdiction. These impacts will vary based on the magnitude of the tornado, but can include structural failure, debris (trees or limbs) causing damage, roofs blown off or windows broken by hail or high winds, and loss of facility functionality (e.g. damaged police station will no longer be able to serve the community). Table 4-8 lists the types and numbers of all of the essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings for the entire county is listed in Table 4-9. The buildings within the county can all expect the same impacts, similar to those discussed for critical facilities. These impacts include structural failure, debris (trees or limbs) causing damage, roofs blown off or windows broken by hail or high winds, and loss of building function (e.g. damaged home will no longer be habitable causing residence to seek shelter).

Infrastructure

During a tornado the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable, it is important to emphasize that any number of these items could become damaged during a tornado. The impacts to these items include broken, failed, or impassable roadways, broken or failed utility lines (e.g. loss of power or gas to community), and railway failure from broken or impassable railways. Bridges could fail or become impassable causing risk to traffic.

The following example scenario is described to gauge the anticipated impacts of tornadoes in the county, in terms of numbers and types of buildings and infrastructure.

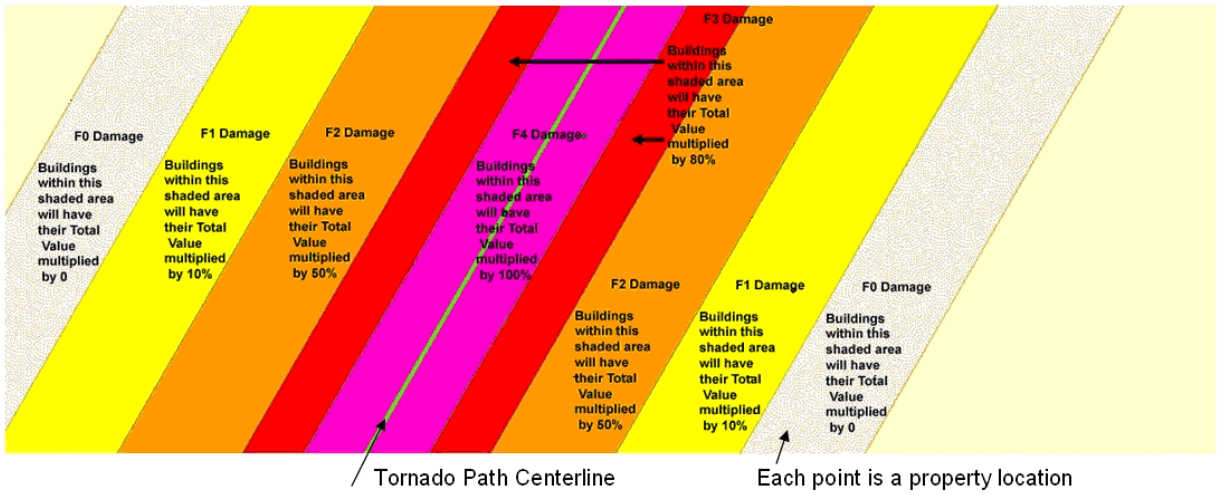
GIS overlay modeling was used to determine the potential impacts of an F4 tornado. The analysis modeled a hypothetical tornado path running for five miles through the town of Rensselaer. The selected widths were modeled after a recreation of the Fujita-Scale guidelines based on conceptual wind speeds, path widths, and path lengths. There is no guarantee that every tornado will fit exactly into one of these six categories. Table 4-12 depicts tornado damage curves as well as path widths.

Table 4-12: Tornado Path Widths and Damage Curves

Fujita Scale	Path Width (feet)	Maximum Expected Damage
F-5	3000	100%
F-4	2400	100%
F-3	1800	80%
F-2	1200	50%
F-1	600	10%
F-0	300	0%

Within any given tornado path there are degrees of damage. The most intense damage occurs within the center of the damage path with a decreasing amount of damage away from the center of the path. This natural process was modeled in GIS by adding damage zones around the tornado path. Figure 4-1 and Table 4-13 describe the zone analysis.

Figure 4-1: GIS Analysis Using Tornado Buffers



Once the hypothetical route is digitized on the map, several buffers are created to model the damage functions within each zone.

An F4 tornado has four damage zones. Total devastation is estimated within 150 feet of the tornado path (the darker-colored Zone 1). The outer buffer is 900 feet from the tornado path (the lightest colored Zone 4), within which 10% of the buildings will be damaged.

Table 4-13: Tornado Zones and Damage Curves

Fujita Scale	Zone	Buffer (feet)	Damage Curve
F-4	4	600-900	10%
F-4	3	300-600	50%
F-4	2	150-300	80%
F-4	1	0-150	100%

The selected hypothetical tornado path is depicted in Figure 4-2, and the damage curve buffers are shown in Figure 4-3.

Figure 4-2: Hypothetical F4 Tornado Path in Jasper County

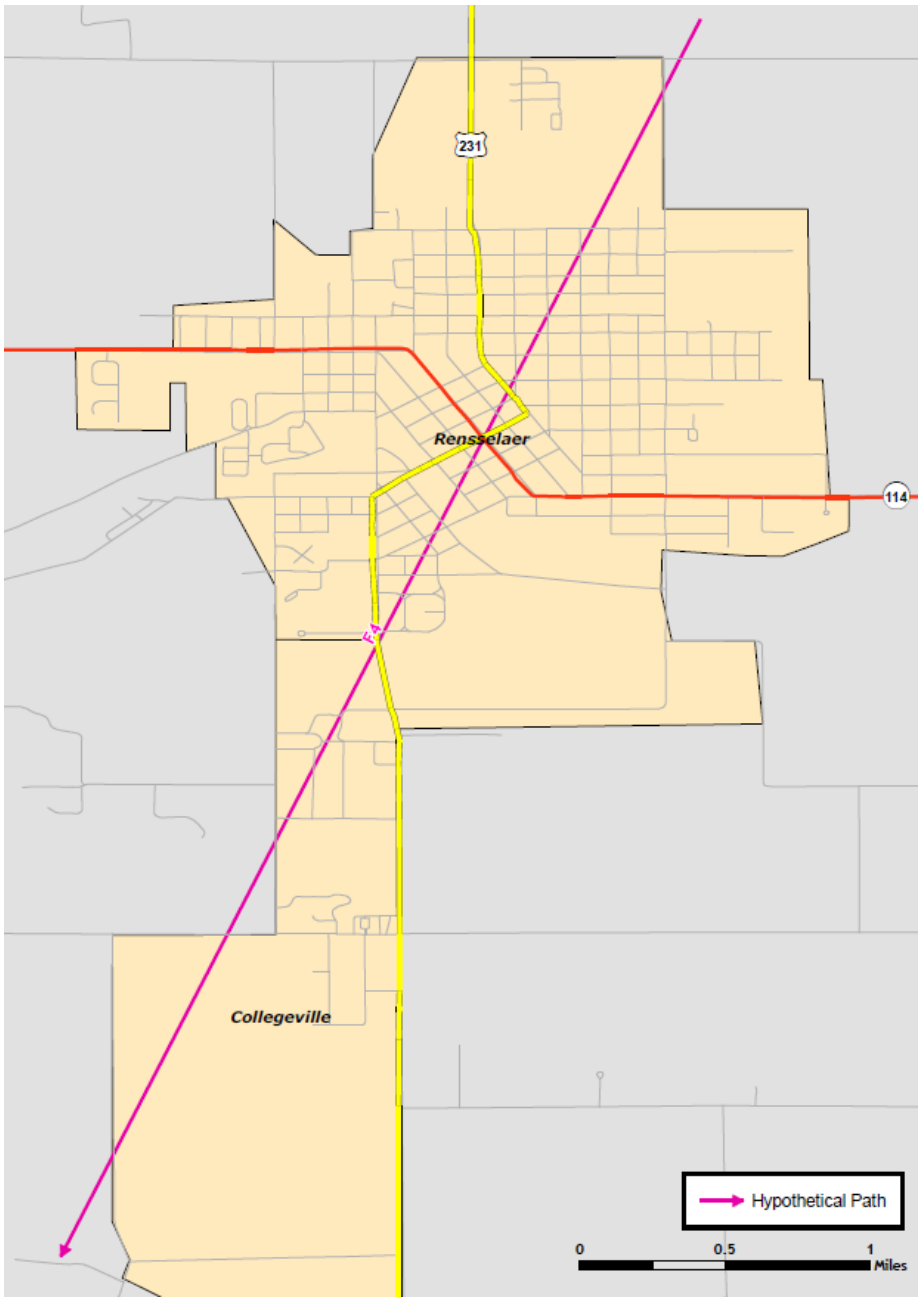
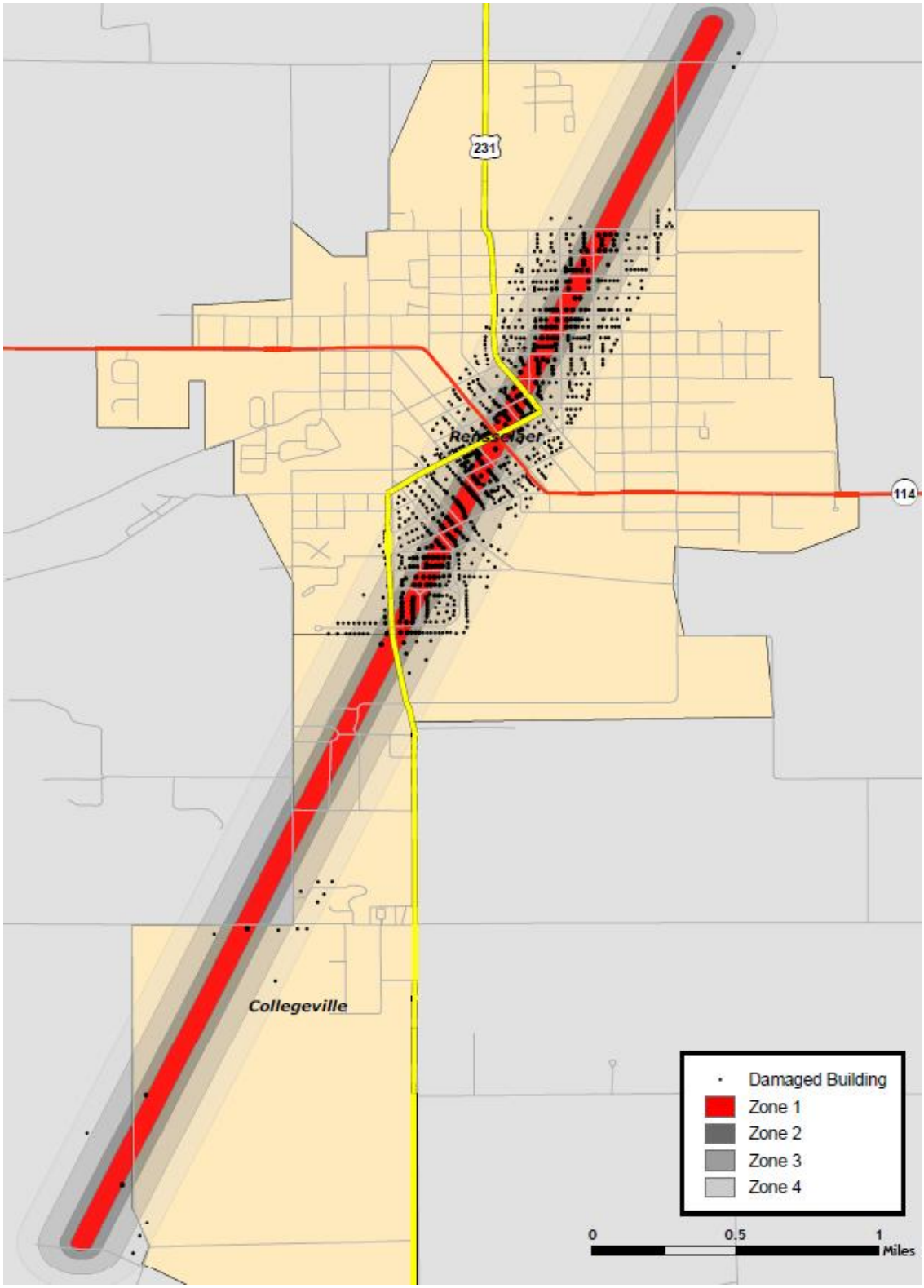


Figure 4-3: Modeled F4 Tornado Damage Buffers in Jasper County



The results of the analysis are depicted in Tables 4-14 and 4-15. The GIS analysis estimates that 855 buildings will be damaged. The estimated building losses were $57.8 million. The building losses are an estimate of building replacement costs multiplied by the percentages of damage. The overlay was performed against parcels provided by Jasper County that were joined with Assessor records showing property improvement.

The Assessor records often do not distinguish parcels by occupancy class when the parcels are not taxable; therefore, the total number of buildings and the building replacement costs for government, religious/non-profit, and education may be underestimated.

Table 4-14: Estimated Numbers of Buildings Damaged by Occupancy Type

Occupancy	Zone 1	Zone 2	Zone 3	Zone 4
Residential	123	123	217	223
Commercial	21	38	44	23
Industrial	3	3	8	7
Agriculture	0	0	0	2
Religious	0	0	0	0
Government	3	3	11	3
Education	0	0	0	0
Total	**150**	**167**	**280**	**258**

Table 4-15: Estimated Building Losses by Occupancy Type (X 1000)

Occupancy	Zone 1	Zone 2	Zone 3	Zone 4
Residential	$11,484	$8,946	$11,007	$2,281
Commercial	$5,986	$6,476	$7,843	$1,348
Industrial	$388	$446	$673	$88
Agriculture	$0	$0	$0	$15
Religious	$0	$0	$0	$0
Government	$0	$0	$0	$0
Education	$0	$0	$0	$0
Total	**$17,859**	**$15,868**	**$19,524**	**$3,732**

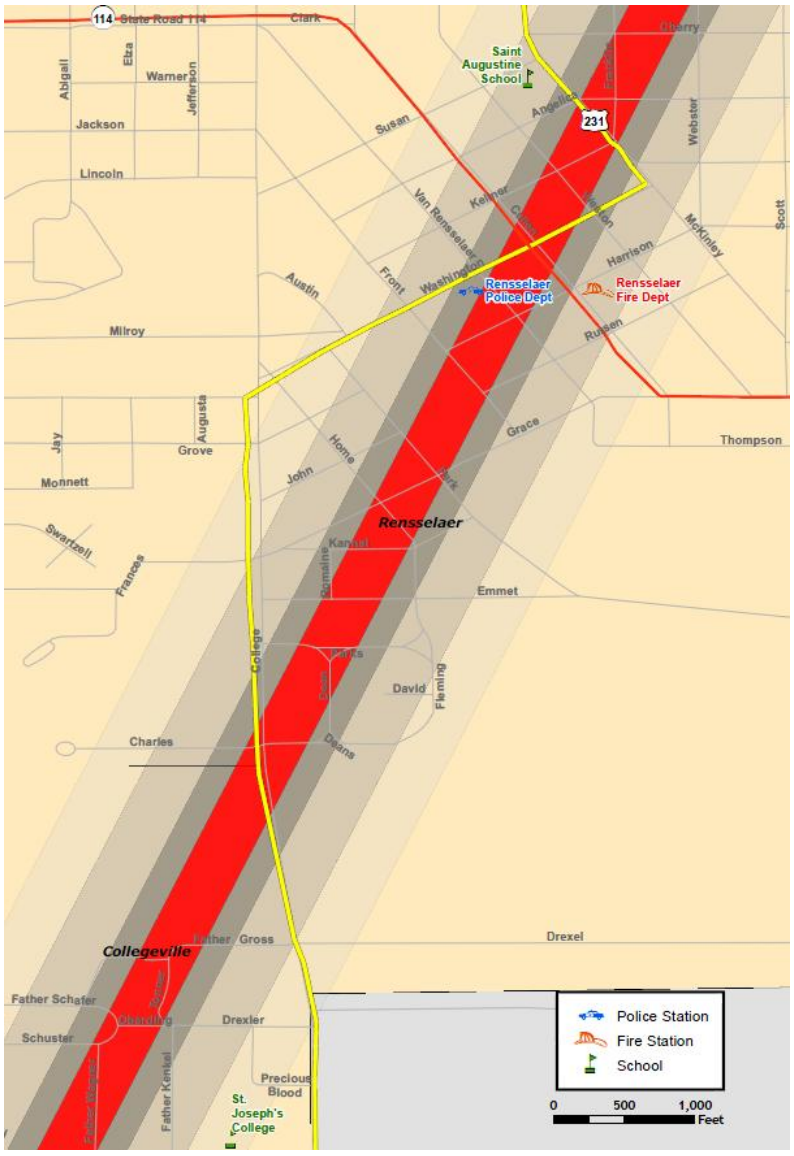
Essential Facilities Damage

There are four essential facilities located within 900 feet of the hypothetical tornado path. The model predicts that one fire station, one police station and two schools would experience damage. The affected facilities are identified in Table 4-16, and their geographic locations are shown in Figure 4-4.

Table 4-16: Estimated Essential Facilities Affected

Name
Rensselaer Fire Department
Rensselaer Police Department
Saint Augustine School
St. Joseph's College

Figure 4-4: Essential Facilities within Tornado Path



Vulnerability to Future Assets/Infrastructure for Tornado Hazard

The entire population and buildings have been identified as at risk because tornadoes can occur anywhere within the State of Indiana, at any time of the day, and during any month of the year. Furthermore, any future development in terms of new construction within the county will be at risk. The building exposure for Jasper County is included in Table 4-9.

All critical facilities in the county and communities within the county are at risk. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Analysis of Community Development Trends

Preparing for severe storms will be enhanced if officials sponsor a wide range of programs and initiatives to address the overall safety of county residents. New structures need to be built with more sturdy construction and those structures already in place need to be hardened to lessen the potential impacts of severe weather. Community warning sirens to provide warnings of approaching storms are also vital to preventing the loss of property and ensuring the safety of Jasper County residents. As natural hazards and man-initiated events with hazardous consequences occur, and they will, a hardened emergency operations center and evacuation facility need to be built to help minimize the consequences of the disaster and hasten the recovery from the event.

4.4.2 Flooding

Hazard Definition for Flooding

Flooding is a significant natural hazard throughout the United States. The type, magnitude, and severity of flooding are functions of the amount and distribution of precipitation over a given area, the rate at which precipitation infiltrates into the ground, the geometry and hydrology of the catchment, and flow dynamics and conditions in and along the river channel. Floods can be classified as one of two types: upstream floods or downstream floods. Both types of floods are common in Indiana. Upstream floods, also called flash floods, occur in the upper parts of drainage basins and are generally characterized by periods of intense rainfall over a short duration. These floods arise with very little warning and often result in locally intense damage, and sometimes loss of life, due to the high energy of the flowing water. Flood waters can snap trees, topple buildings, and easily move large boulders or other structures. Six inches of rushing water can upend a person; another 18 inches might carry off a car. Generally, upstream floods cause damage over relatively localized areas, but they can be quite severe in the local areas where they occur. Urban flooding is a type of upstream flood. Urban flooding involves the overflow of storm drain systems and can be the result of inadequate drainage combined with heavy rainfall or rapid snowmelt. Upstream or flash floods can occur at anytime of the year in Indiana, but they are most common in the spring and summer months.

Downstream floods, sometimes called riverine floods, refer to floods on large rivers at locations with large upstream catchments. Downstream floods are typically associated with precipitation events that are of relatively long duration and occur over large areas. Flooding on small tributary streams may be limited, but the contribution of increased runoff may result in a large flood downstream. The lag time between precipitation and time of the flood peak is much longer for downstream floods than for upstream floods, generally providing ample warning for people to move to safe locations and, to some extent, secure some property against damage. Riverine flooding on the large rivers of Indiana generally occurs during either the spring or summer.

Hazard Definition for Dam and Levee Failure

Dams are structures that retain or detain water behind a large barrier. When full or partially full, the difference in elevation between the water above the dam and below creates large amounts of potential energy, creating the potential for failure. The same potential exists for levees when they serve their purpose, which is to confine flood waters within the channel area of a river and exclude that water from land or communities land-ward of the levee. Dams and levees can fail due to either: 1) water heights or flows above the capacity for which the structure was designed; or 2) deficiencies in the structure such that it cannot hold back the potential energy of the water. If a dam or levee fails, issues of primary concern include loss of human life/injury, downstream property damage, lifeline disruption (of concern would be transportation routes and utility lines required to maintain or protect life), and environmental damage.

Many communities view both dams and levees as permanent and infinitely safe structures. This sense of security may well be false, leading to significantly increased risks. Both downstream of dams and on floodplains protected by levees, security leads to new construction, added

infrastructure, and increased population over time. Levees in particular are built to hold back flood waters only up to some maximum level, often the 100-year (1% annual probability) flood event. When that maximum is exceeded by more than the design safety margin, then the levee will be overtopped or otherwise fail, inundating communities in the land previously protected by that levee. It has been suggested that climate change, land-use shifts, and some forms of river engineering may be increasing the magnitude of large floods and the frequency of levee-failure situations.

In addition to failure that results from extreme floods above the design capacity, levees and dams can fail due to structural deficiencies. Both dams and levees require constant monitoring and regular maintenance to assure their integrity. Many structures across the U.S. have been under-funded or otherwise neglected, leading to an eventual day of reckoning in the form either of realization that the structure is unsafe or, sometimes, an actual failure. The threat of dam or levee failure may require substantial commitment of time, personnel, and resources. Since dams and levees deteriorate with age, minor issues become larger compounding problems, and the risk of failure increases.

Previous Occurrences for Flooding

The National Climatic Data Center (NCDC) database reported 14 flood events in Jasper County since 1950. In January of 2008, Lake Arthur Estates in Remington was evacuated after four to five feet of water flooded the trailer park. Interstate 65 was closed near mile marker 210 after Carpenter Creek overflowed its banks and flooded all lanes of traffic. Numerous roads and low - lying areas were flooded. Total rainfall reached 5.15 inches in Remington and 3.53 inches in Rensselaer. Heavy rain fell across most of northwest Indiana, which caused significant flooding. *Source: NCDC*

The Jasper County NCDC recorded floods are identified in Table 4-17. Additional details for NCDC events are included in Appendix D. In addition, USGS stream gauge data of historical crests are listed in Appendix H.

Table 4-17: Jasper County Previous Occurrences of Flooding*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Jasper	1/1/1993	Flood	N/A	0	0	5.0M	0
Jasper	10/17/1993	Flood	N/A	0	0	500K	500K
Jasper	7/17/1996	Flash Flood	N/A	0	0	0	0
Rensselaer	5/3/1998	Urban/sml Stream Fld	N/A	0	0	0	0
North Portion	7/21/2003	Flash Flood	N/A	0	0	0	0
Demotte	5/14/2004	Flash Flood	N/A	0	0	0	0
Remington	5/30/2004	Flash Flood	N/A	0	0	0	0
Demotte	6/12/2004	Flash Flood	N/A	0	0	0	0
Jasper	2/16/2005	Flood	N/A	0	0	0	0
Rensselaer	8/28/2006	Flood	N/A	0	0	0	0
Remington	3/23/2007	Flood	N/A	0	0	0	0

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Gifford	6/26/2007	Flash Flood	N/A	0	0	0	0
North Newton / Remington	1/8/2008	Flash Flood	N/A	1	0	1.0M	0
North Newton	1/8/2008	Flood	N/A	0	0	0	0

* NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

Previous Occurrences for Dam and Levee Dam Failure

According to the Jasper County CEMP, there are no dams in the National Dam Inventory.

Repetitive Loss Properties

FEMA defines a repetitive loss structure as a structure covered by a contract of flood insurance issued under the National Flood Insurance Program (NFIP), which has suffered flood loss damage on two occasions during a 10-year period that ends on the date of the second loss, in which the cost to repair the flood damage is 25% of the market value of the structure at the time of each flood loss.

Indiana Emergency Management was contacted to determine the location of repetitive loss structures. Jasper County has two repetitive loss structures within the county. The total amount paid for building replacement and building contents for damages to these repetitive loss structures is $13,421.17. Table 4-18 describes the loss structures in terms of occupancy and jurisdiction.

Table 4-18: Jasper County Repetitive Loss Structures

Jurisdiction	Occupancy Type	Number of Properties	Total Paid
Remington	Single-Family	1	$10,037.45
Rensselaer	Single-Family	1	$3,383.72

Geographic Location for Flooding

Most river flooding occurs in early spring and is the result of excessive rainfall and/or the combination of rainfall and snowmelt. Severe thunderstorms may cause flooding during the summer or fall, but tend to be localized.

The primary source of river flooding in Jasper County is the Iroquois River. Flash floods, brief heavy flows in small streams or normally dry creek beds, also occur within the county. Flash flooding is typically characterized by high-velocity water, often carrying large amounts of debris. Urban flooding involves the overflow of storm drain systems and is typically the result of inadequate drainage following heavy rainfall or rapid snowmelt.

The Indiana Department of Natural Resources (IDNR) recently digitized the paper FEMA Flood Insurance Rate Maps (FIRM). These digital files, although not official FIRMs, were used to identify specific stream reaches for analysis. The overbank flooding areas are depicted on the map in Appendix E. Flash flooding may occur countywide.

The National Oceanic and Atmospheric Administration (NOAA) Advanced Hydrologic Prediction Service provides information from gauge locations at points along various rivers across the United States. For Jasper County, data is provided for one point: Iroquois River at Rensselaer. Appendix H lists information pulled from the NOAA website, which includes flood categories, historical crests, and details about anticipated impacts to agricultural lands, dams, levees, and other built structures at significant flood crest levels.

Geographic Location for Dam and Levee Failure

The National Inventory of Dams identified no dams in Jasper County. A review of the Indiana Department of Natural Resources (IDNR) files identified one agricultural levee. Jasper County's levee information is detailed in Table 4-19.

Table 4-19: Jasper County Levees

Levee Name	Location
Marbles Power Ditch	Southeast riverbank of Kankakee River, near Hebron; Wheatfield Township, Jasper County

Hazard Extent for Flooding

The HAZUS-MH flood model is designed to generate a flood depth grid and flood boundary polygon by deriving hydrologic and hydraulic information based upon user-provided elevation data or by incorporating selected output from other flood models. HAZUS-MH was used to model the Base Flood Elevation (BFE). The BFE is defined as the area that has a 1% chance of flooding in any given year. The analysis used the HAZUS-MH level one methodology, which performs the entire hydrologic and hydraulic modeling processes based upon an existing digital elevation model. The model used Flood Information Study (FIS) discharges when the information was available.

Flood hazard scenarios were modeled using GIS analysis and HAZUS-MH. The flood hazard modeling was based on historical occurrences and current threats. Existing IDNR flood maps were used to identify the areas of study. These digital files, although not official FIRMs, were used to identify specific stream reaches for analysis to model the BFE. Planning team input and a review of historical information provided additional information on specific flood events.

Hazard Extent for Dam and Levee Failure

Dams that are assigned the low (L) hazard potential classification are those where failure or misoperation does not result in probable loss of human life or losses related to economics and/or environment. Losses are principally limited to the owner's property. Dams assigned the significant (S) hazard classification are those dams where failure or misoperation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of

lifeline facilities, or impact other concerns. Dams classified as significant hazard potential dams are often located in predominantly rural or agricultural areas, but could be located in populated areas with a significant amount of infrastructure. Dams assigned the high (H) hazard potential classification are those dams where failure or misoperation has the highest risk to cause loss of human life and significant damage to buildings and infrastructure.

Accurate mapping of the risks of flooding behind levees depends on knowing the condition and level of protection the levees actually provide. FEMA and the U.S. Army Corps of Engineers are working together to make sure that flood hazard maps clearly reflect the flood protection capabilities of levees, and that the maps accurately represent the flood risks posed to areas situated behind them. Levee owners—usually states, communities, or in some cases private individuals or organizations—are responsible for ensuring that the levees they own are maintained according to their design. In order to be considered creditable flood protection structures on FEMA's flood maps, levee owners must provide documentation to prove the levee meets design, operation, and maintenance standards for protection against the one-percent-annual chance flood.

Calculated Priority Risk Index for Flooding

Based on historical information and the HAZUS-MH flooding analysis results, the probability of flooding is highly likely. According to the Calculated Priority Risk Index (CPRI), flooding ranked as the number one hazard in Jasper County.

CPRI = Probability X .45 + Magnitude/Severity X .30 + Warning Time X .15 + Duration of event X .10.

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
4 x .45	+	**2** x .30	+	**3** x .15	+	**3** x .10	=	**3.15**

Calculated Priority Risk Index for Dam and Levee Failure

According to the Jasper County CEMP, there are no dams in the National Dam Inventory.

Vulnerability Analysis for Flooding (HAZUS-MH Analysis Using 100-Year DFIRM Boundary and Default Building Inventory)

HAZUS-MH generated the flood depth grid for a 100-year return period and made calculations by clipping the USGS 30-m DEM to the DFIRM boundary. Next, HAZUS-MH estimated the damages for Jasper County by utilizing default aggregate building inventory census data.

Building Inventory

A table of the building replacement costs (types and numbers of buildings) for the facilities identified in the DFIRM flood areas are listed in Table 4-20. These buildings can expect impacts similar to those discussed for the critical facilities. These include structural failure, extensive water damage to the facility, and loss of facility functionality (i.e. residential buildings may no longer be able to provide shelter to their inhabitants).

Table 4-20: Jasper County HAZUS-MH Analysis Total Economic Loss (100-Year Flood)

General Occupancy	Total Damaged Buildings	Building Loss (X 1000)	Total Economic Loss (X 1000)
Agricultural	0	$139	$748
Commercial	0	$1,078	$4,853
Education	0	$10	$120
Government	0	$10	$150
Industrial	0	$211	$697
Religious/Non-Profit	0	$75	$586
Residential	0	$1,202	$2,277
Total	**0**	**$2,725**	**$9,431**

The reported building counts should be interpreted as degrees of loss rather than exact numbers of buildings exposed to flooding. These numbers were derived from aggregate building inventories, which were assumed to be dispersed evenly across census blocks. HAZUS-MH requires that a predetermined amount of square footage of a typical building sustains damage in order to produce a damaged building count. If only a minimal amount of building damage is predicted, it is possible to see no damaged building counts, even while seeing economic losses.

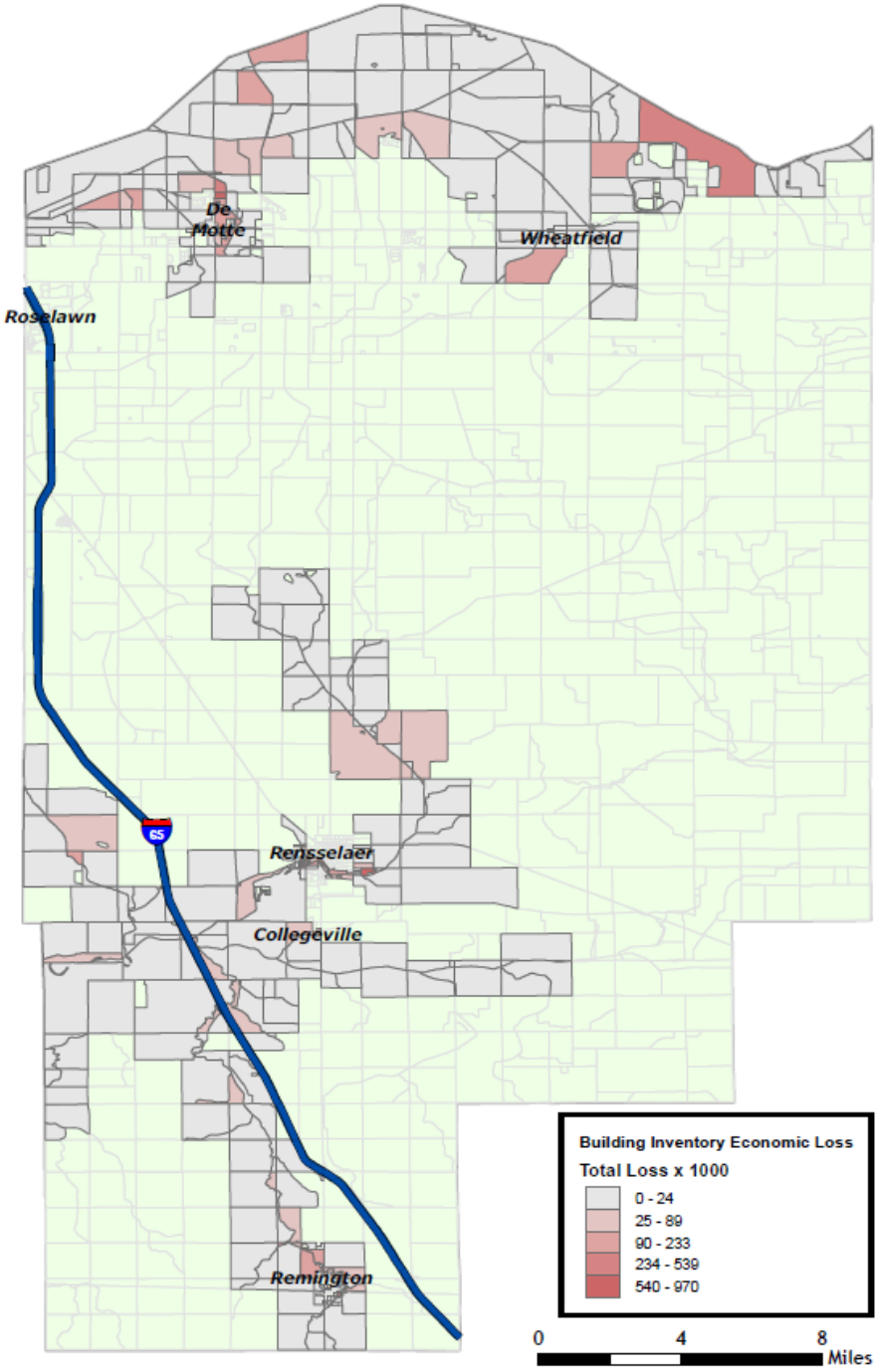
Figure 4-5 depicts the flood boundary from the HAZUS-MH analysis. HAZUS-MH estimates the 100-year flood would result in $2.7 million in building losses and $9.4 million in economic losses.

Figure 4-5: Jasper County HAZUS-MH Analysis (100-Year Flood)

HAZUS-MH estimates zero census blocks affected by the modeled flood event, with losses exceeding $1 million. The distribution of losses is shown in Figure 4-6.

HAZUS-MH aggregate loss analysis is evenly distributed across a census block. Census blocks of concern should be reviewed in more detail to determine the actual percentage of facilities that fall within the flood hazard areas. The aggregate losses reported in this study may be overstated.

Figure 4-6: Jasper County Total Economic Loss (100-Year Flood)



Essential Facilities

An essential facility will encounter many of the same impacts as other buildings within the flood boundary. These impacts can include structural failure, extensive water damage to the facility and loss of facility functionality (e.g. a damaged police station will no longer be able to serve the community). A complete list of all the critical facilities, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

The HAZUS-MH analysis identified one school, one care facility, one fire department, and one police department that may be subject to flooding. A list of the essential facilities within Jasper County is given in Table 4-21. A map of essential facilities potentially at risk to flooding is shown in Figures 4-7 and 4-8.

Table 4-21: Jasper County Damaged Essential Facilities

Name
Covenant Christian High School
Alternacare Nursing Home
Keener Township Fire Department
Demotte Police Department

Figure 4-7: Boundary of 100-Year Flood Overlaid with Essential Facilities

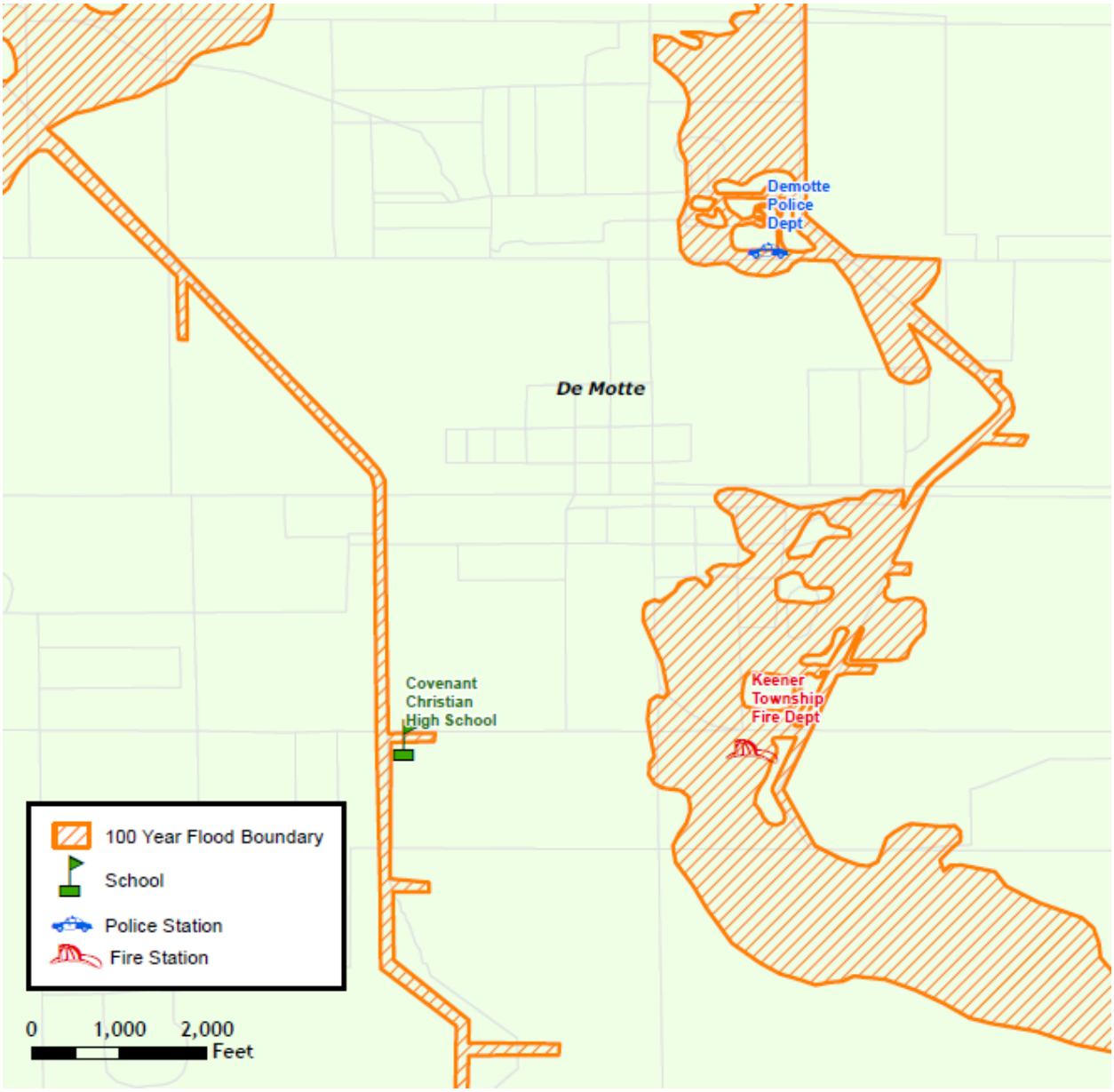
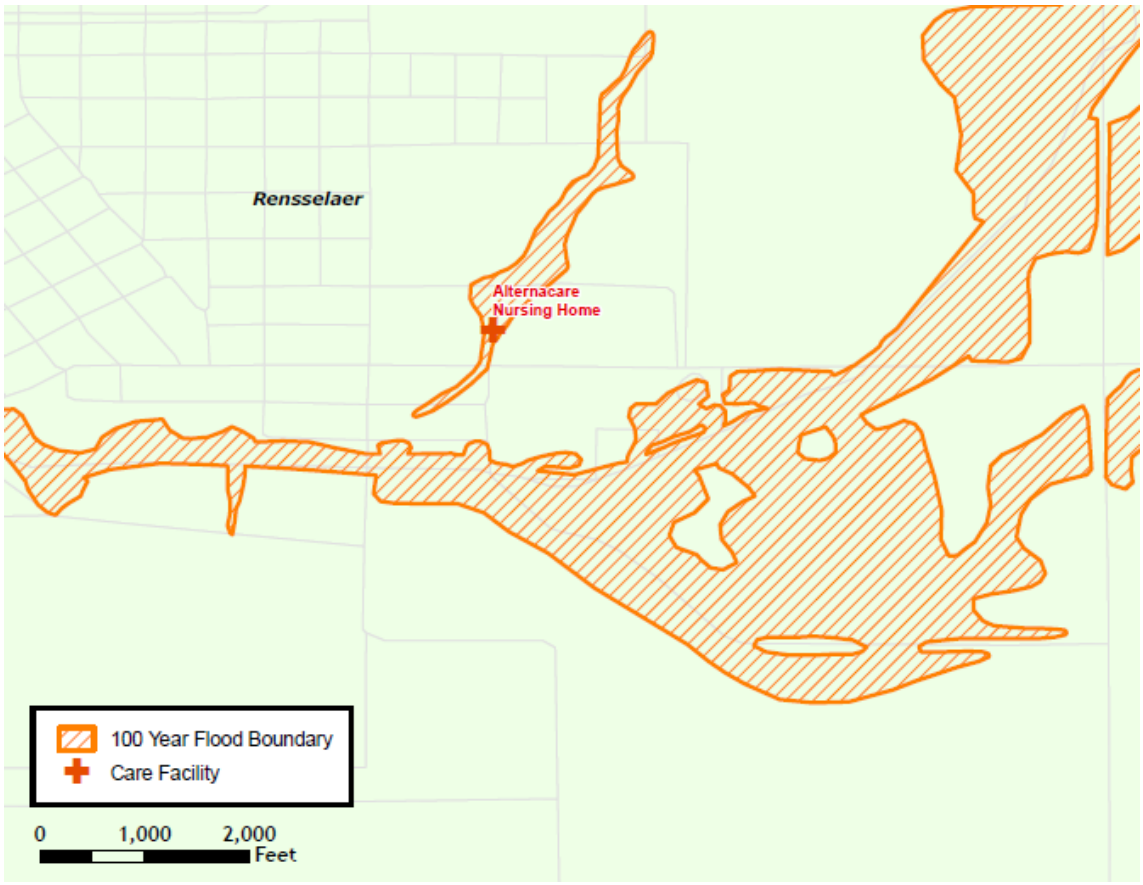


Figure 4-8: Boundary of 100-Year Flood Overlaid with Essential Facilities



HAZUS-MH Analysis Using 100-Year DFIRM Boundary and County Parcels

HAZUS-MH generated the flood depth grid for a 100-year return period and made calculations by clipping the USGS 30-m DEM to the DFIRM boundary. Next, HAZUS-MH utilized a user-defined analysis of Jasper County with site-specific parcel data provided by the county.

HAZUS-MH estimates the 100-year flood would damage 671 buildings. The total estimated numbers of damaged buildings are given in Table 4-22. Figure 4-9 depicts the Jasper County parcel points that fall within the 100-year DFIRM floodplain. Figures 4-10 and 4-11 highlight flood-prone buildings within the DFIRM floodplain areas in Rensselaer and Demotte.

Table 4-22: Jasper County Potential Flood-Prone Buildings

General Occupancy	Total Damaged Buildings	Total Building Damage X 1,000
Residential	440	$8,814
Commercial	26	$720
Industrial	8	$784
Agricultural	130	$926
Religious	2	$0
Government	63	$0
Education	2	$0
Total	**671**	**$11,244**

Figure 4-9: Jasper County Buildings in Floodplain (100-Year Flood)

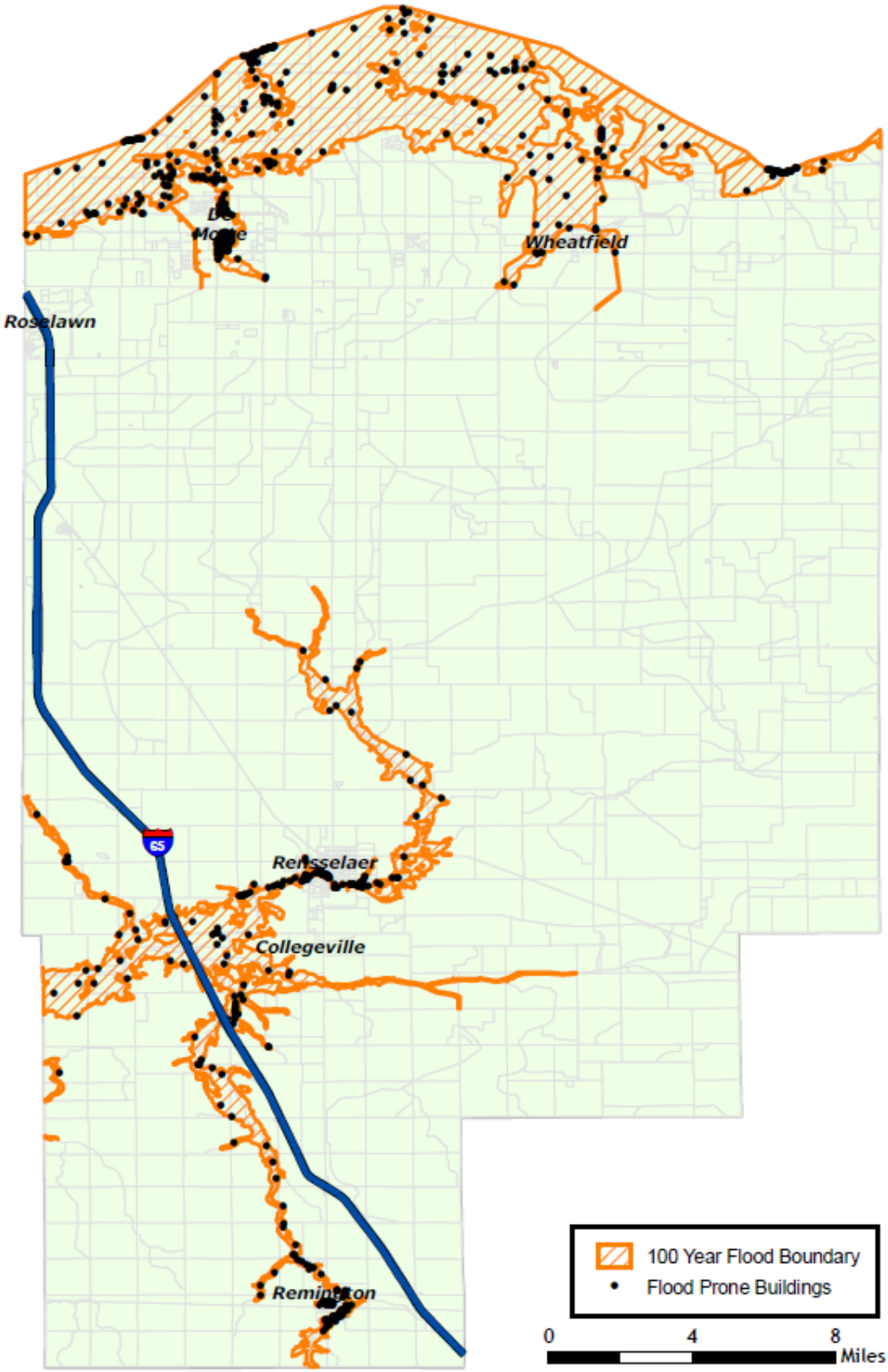


Figure 4-10: Jasper County Urban Areas (Rensselaer) Flood-Prone Areas (100-Year Flood)

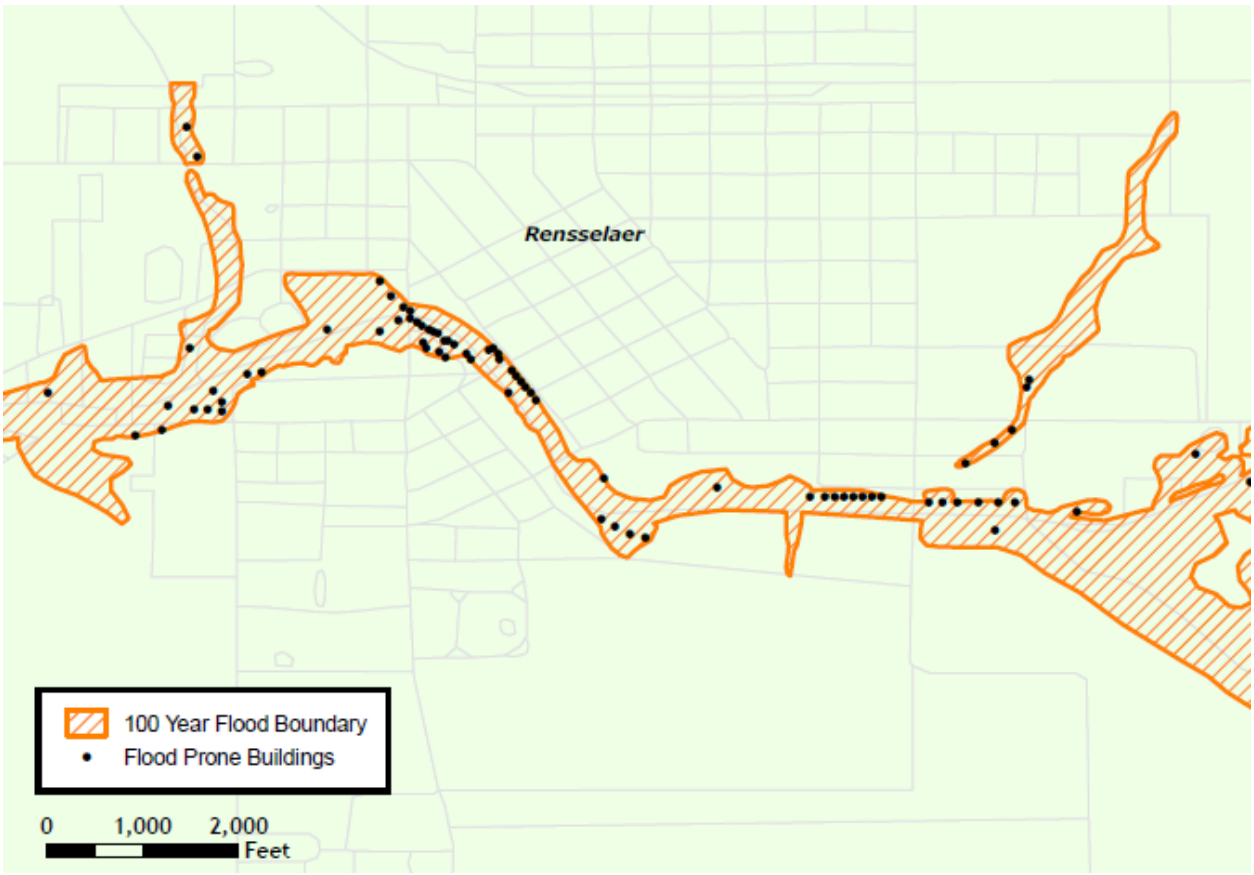
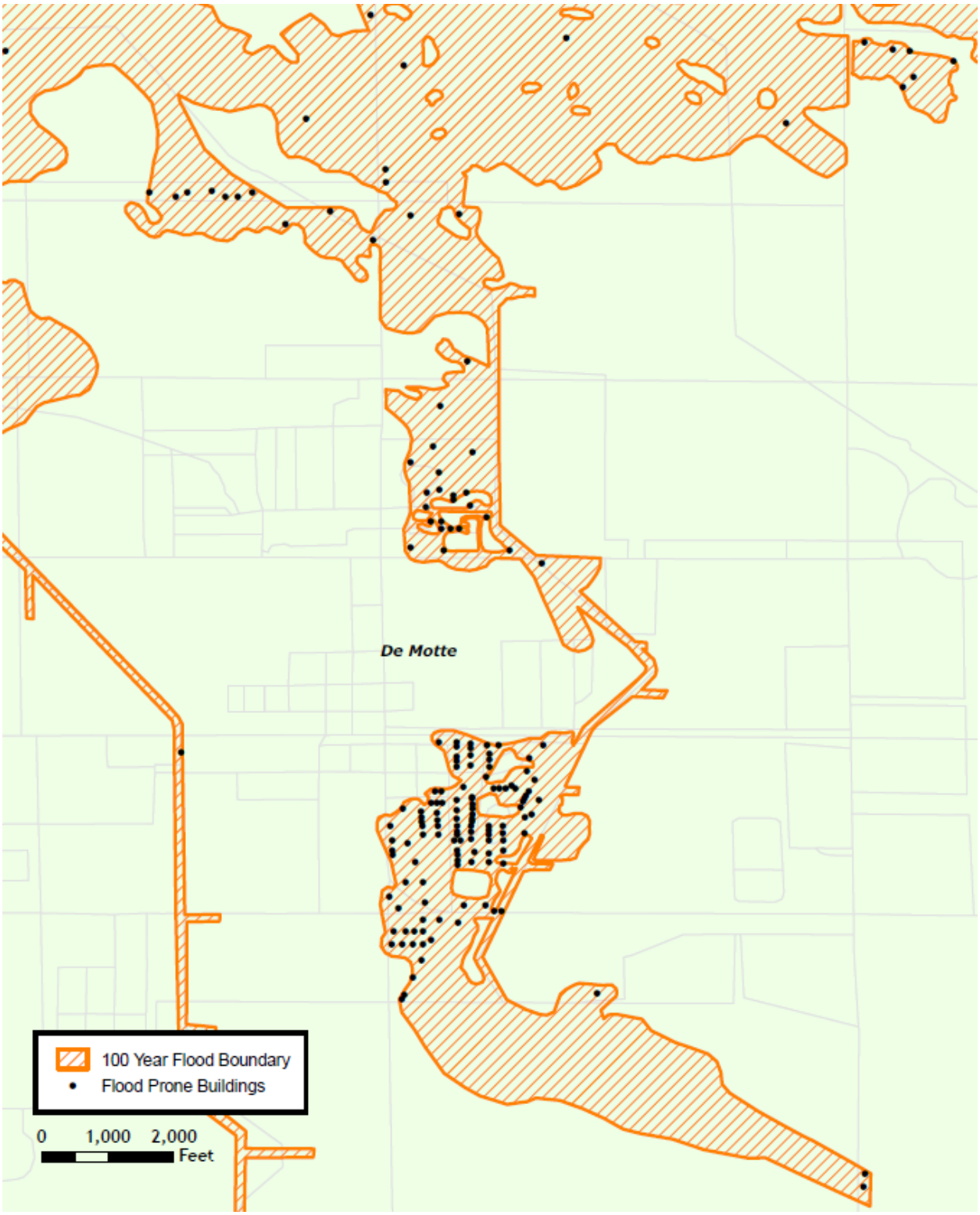


Figure 4-11: Jasper County Urban Areas (Demotte) Flood-Prone Areas (100-Year Flood)



Flash flooding could affect any location within this jurisdiction; therefore, the entire county's population and buildings are vulnerable to a flash flood. These structures can expect the same impacts as discussed in a riverine flood.

Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G. Table 4-9 lists the economic exposure and building counts from the flood risk analysis by general occupancy for the county.

Vulnerability Analysis for Dam and Levee Failure

An Emergency Action Plan (EAP) is required to assess the effect of dam failure on these communities. In order to be considered creditable flood protection structures on FEMA's flood maps, levee owners must provide documentation to prove the levee meets design, operation and maintenance standards for protection against the "one-percent-annual chance" flood.

Vulnerability to Future Assets/Infrastructure for Flooding

Flash flooding may affect nearly every location within the county; therefore all buildings and infrastructure are vulnerable to flash flooding. Currently, the Jasper County Planning Commission reviews new development for compliance with the local zoning ordinance. At this time no construction is planned within the area of the 100-year floodplain. Therefore, there is no new construction which will be vulnerable to a 100-year flood.

Jasper County zoning ordinances prohibit construction in a flood plain that would result in an increase in flood damages or potential flood damages. The development of facilities housing or utilizing hazardous materials is not permitted in a flood plain unless specific requirements and approvals are satisfied.

Vulnerability to Future Assets/Infrastructure for Dam and Levee Failure

The Jasper County Plan Commission reviews new development for compliance with the local zoning ordinance.

Analysis of Community Development Trends

Areas with recent development within the county may be more vulnerable to drainage issues. Storm drains and sewer systems are usually most susceptible, which can cause the back up of water, sewage, and debris into homes and basements, causing structural and mechanical damage as well as creating public health hazards and unsanitary conditions.

Controlling floodplain development is the key to reducing flood-related damages. As natural hazards and man-initiated events with hazardous consequences occur, and they will, a harden emergency operations center and evacuation facility or facilities need to be built to help minimize the consequences of the disaster and hasten the recovery from the event.

4.4.3 Earthquake Hazard

Hazard Definition for Earthquake Hazard

An earthquake is a sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the Earth's surface. For hundreds of millions of years, the forces of plate tectonics have shaped the Earth as the huge plates that form the Earth's surface move slowly over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together unable to release the accumulating energy. When the accumulated energy grows strong enough the plates break free causing the ground to shake. Most earthquakes occur at the boundaries where the plates meet; however, some earthquakes occur in the middle of plates, as is the case for seismic zones in the Midwestern United States. The most seismically active area is referred to as the New Madrid Seismic Zone. Scientists have learned that the New Madrid fault system may not be the only fault system in the Central U.S. capable of producing damaging earthquakes. The Wabash Valley fault system in Illinois and Indiana shows evidence of large earthquakes in its geologic history, and there may be other, as yet unidentified, faults that could produce strong earthquakes.

Ground shaking from strong earthquakes can collapse buildings and bridges; disrupt gas, electric, and phone service; and sometimes trigger landslides, avalanches, flash floods, fires, and huge destructive ocean waves (tsunamis). Buildings with foundations resting on unconsolidated landfill and other unstable soil; and trailers and homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area it may cause deaths, injuries, and extensive property damage. Magnitude measures the energy released at the source of the earthquake. Magnitude is determined from measurements on seismographs. Intensity measures the strength of shaking produced by the earthquake at a certain location. Intensity is determined from effects on people, human structures, and the natural environment. Tables 4-23 and 4-24 list earthquake magnitudes and their corresponding intensities.
http://earthquake.usgs.gov/learning/topics/mag_vs_int.php

Table 4-23: Abbreviated Modified Mercalli Intensity Scale

Mercalli Intensity	Description
I	Not felt except by a very few under especially favorable conditions.
II	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.

Mercalli Intensity	Description
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Table 4-24: Earthquake Magnitude vs. Modified Mercalli Intensity Scale

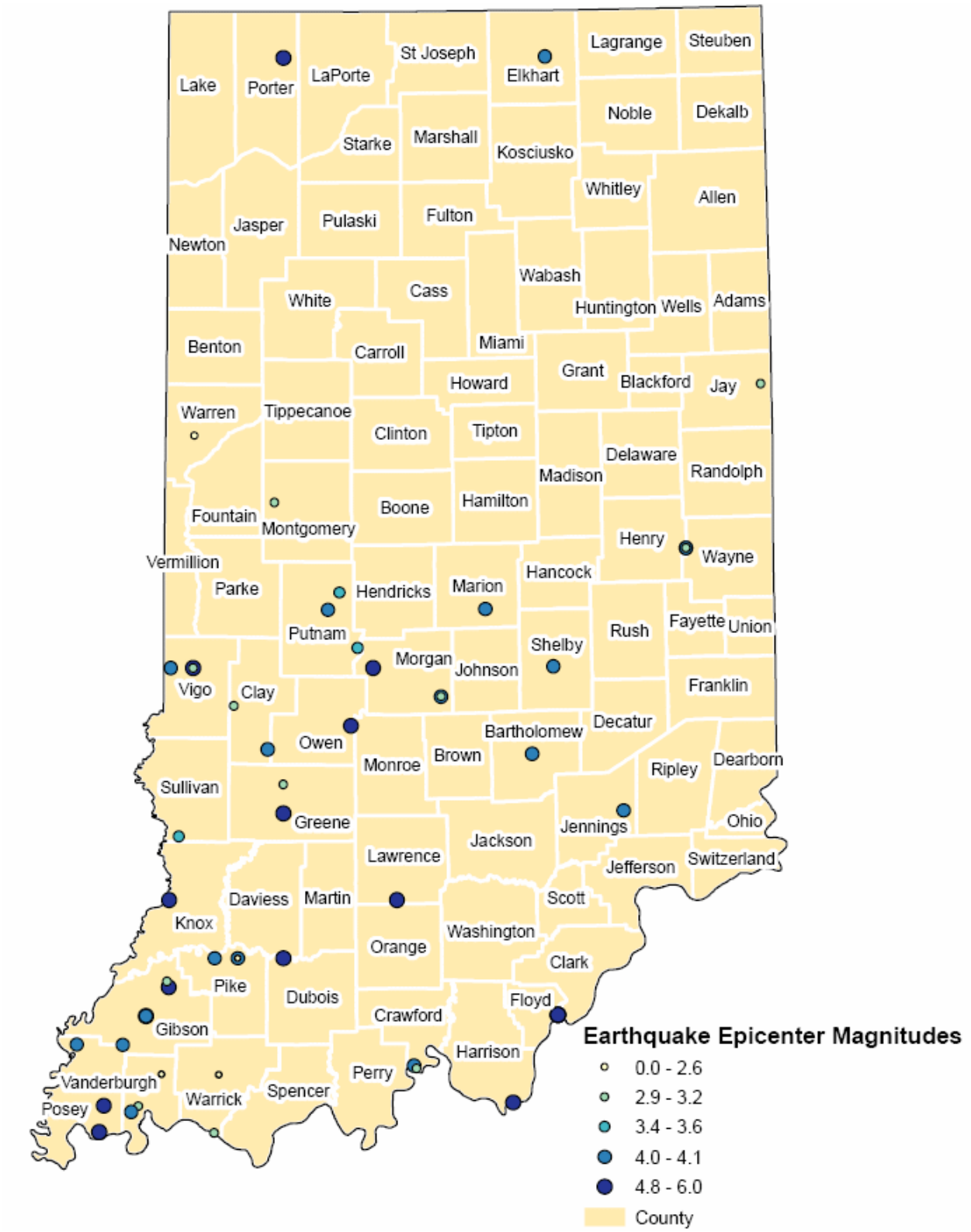
Earthquake Magnitude	Typical Maximum Modified Mercalli Intensity
1.0 - 3.0	I
3.0 - 3.9	II - III
4.0 - 4.9	IV - V
5.0 - 5.9	VI - VII
6.0 - 6.9	VII - IX
7.0 and higher	VIII or higher

Previous Occurrences for Earthquake Hazard

Approximately 40 earthquakes have occurred in Indiana for which reasonably accurate records exist. They vary in Moment Magnitude from a low of approximately M=2.0 to a high of M=5.2. The consensus of opinion among seismologists working in the Midwest is that a magnitude 5.0 to 5.5 event could occur virtually anywhere at any time throughout the region. The last earthquake to occur in Indiana—as of the date of this report—occurred on September 12, 2004 just north of Shelbyville and measured 3.6 in magnitude. The largest prehistoric earthquake documented in the state occurred at Vincennes 6,100 years ago and is known by the size and physical character of sandblows formed during the quake to have had a Moment Magnitude of 7.4.

According to the Indiana Geological Survey, no earthquakes have been recorded with epicenters in Jasper County. Historical epicenters outside of Jasper County are included in Figure 4-12, although information related to the impacts to Jasper County from these events is limited.

Figure 4-12: Historical Earthquake Epicenters



The most damaging Indiana earthquake originating within the state occurred on September 27, 1909 near the Indiana border between Vincennes and Terre Haute. Some chimneys fell, several building walls cracked, light connections severed, and pictures shook from the walls. It was felt throughout Indiana and parts of Iowa, Kentucky, Missouri, Arkansas, and probably in parts of Kansas, covering an area of 30,000 square miles.

Another damaging earthquake originating in Indiana occurred on April 29, 1899; it rated intensity VI to VII on the Modified Mercalli Scale. It was strongest in Jeffersonville and Shelbyville, and in Vincennes, chimneys crumbled and walls cracked. It was felt over an area of 40,000 square miles.

In 1876, twin shocks 15 minutes apart were felt over an area of 60,000 square miles. A shock in 1887 centered near Vincennes was felt over 75,000 square miles; an 1891 shock damaged property and frightened people in a church in Evansville.

Indiana has also suffered from damage caused by earthquakes originating in neighboring states. The worst occurred on November 9, 1968, and centered near Dale in southern Indiana. The shock, a magnitude of 5.3, was felt over 580,000 square miles and 23 states including all of Indiana. Intensity VII was reported from Cynthiana, where chimneys cracked, twisted, and toppled; at Fort Branch, where groceries fell from shelves and a loud roaring noise was heard; and in Mount Vernon, New Harmony, Petersburg, Princeton, and Stewartsville, all of which had similar effects. At Poseyville, "Fish jumped out of the rivers, ponds, and lakes."

Almost exactly 10 years earlier on November 7, 1958, an earthquake originating near Mt. Carmel, Indiana causing plaster to fall at Fort Branch. Roaring and whistling noises were heard at Central City, and the residents of Evansville thought there had been in an explosion or plane crash. It was felt over 33,000 square miles of Indiana, Indiana, Missouri, and Kentucky.

On March 2, 1937, a shock centering near Anna, Ohio threw objects from shelves at Fort Wayne and some plaster fell. Six days later, another shock originating at Anna brought pictures crashing down and cracked plaster in Fort Wayne and was strongly felt in Lafayette.

The great New Madrid earthquakes of 1811 and 1812 must have strongly affected the state, particularly the southwestern part, but there is little information available from these frontier times.

[The above history was abridged from Earthquake Information Bulletin, Volume 4, Number 4, July-August 1972.]

1827 Jul 5 11:30 4.8M Intensity VI
Near New Harmony, Indiana (38.0N 87.5W)
The earthquake cracked a brick store at New Harmony, Indiana, and greatly alarmed some people. It was described as violent at New Madrid, Missouri, and severe in St. Louis. It also alarmed many in Cincinnati, Ohio, and Frankfort, Kentucky.

1827 Aug 7 04:30 4.8M Intensity V
Southern Indiana (38.0N 88.0W)

1827 Aug 7 07:00 4.7M Intensity V
Southern Indiana (38.0N 88.0W)

1887 Feb 6 22:15 4.6M Intensity VI
Near Vincennes, Indiana (38.7N 87.5W)
This shock was strongest in southwest Indiana and southeast Indiana. Plaster was shaken from walls in Vincennes, west of Terre Haute, and in Martinsville; a cornice reportedly fell from a building in Huntington, Indiana. It was felt distinctly in Evansville, Indiana, but only slightly in the outskirts of St. Louis, Missouri. The shockwave was also reported in Louisville, Kentucky.

1891 Jul 27 02:28 4.1M Intensity VI
Evansville, Indiana (37.9N 87.5W)
A strong local earthquake damaged a wall on a hotel, broke dishes, and overturned furniture in Evansville. The shock also was strong near Evansville in Mount Vernon, and Newburgh Indiana; and at Hawesville, Henderson, and Owensboro, Kentucky.

1921 Mar 14 12:15 4.4M Intensity VI
Near Terre Haute, Indiana (39.5N 87.5W)
This earthquake broke windows in many buildings and sent residents rushing into the streets in Terre Haute. Small articles were overturned in Paris, Indiana, about 35 km northwest of Terre Haute.

1925 Apr 27 04:05 4.8M Intensity VI
Wabash River valley, near Princeton, Indiana (38.2N 87.8W)
Chimneys were downed in Princeton and in Carmi, Indiana; 100 km southwest chimneys were broken in Louisville, Kentucky. Crowds fled from the theaters in Evansville, Indiana. The affected area included parts of Indiana, Indiana, Kentucky, Missouri, and Ohio.

The above text was taken from http://earthquake.usgs.gov/regional/states/indiana/history.php

Geographic Location for Earthquake Hazard

Jasper County occupies a region susceptible to two earthquake threats: the threat of an earthquake along the Wabash Valley Fault System and the threat of an event near Anna in Shelby County Ohio. Return periods for large earthquakes within the New Madrid System are estimated to be 500 years; moderate quakes between magnitude 5.5 and 6.0 can recur within approximately 150 years or less. The Wabash Valley Fault System is a sleeper that threatens the southwest quadrant of the state and may generate an earthquake large enough to cause damage as far north and east as Jasper County.

Hazard Extent for Earthquake Hazard

The extent of the earthquake is countywide. One of the most critical sources of information that is required for accurate assessment of earthquake risk is soils data. A NEHRP compliant soils map was used for the analysis which was provided by the Indiana Geological Survey (IGS).

Calculated Priority Risk Index for Earthquake Hazard

Based on historical information as well as current USGS and IGS research and studies, future earthquakes in Jasper County are possible. According to the CPRI, earthquake is ranked as the number five hazard.

CPRI = Probability X .45 + Magnitude/Severity X .30 + Warning Time X .15 + Duration of event X .10.

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
2 x .45	+	**2** x .30	+	**4** x .15	+	**2** x .10	=	**2.3**

Vulnerability Analysis for Earthquake Hazard

This hazard could impact the entire jurisdiction equally; therefore, the entire county's population and all buildings are vulnerable to an earthquake and can expect the same impacts within the affected area. To accommodate this risk this plan will consider all buildings located within the county as vulnerable.

Critical Facilities

All critical facilities are vulnerable to earthquakes. A critical facility would encounter many of the same impacts as any other building within the county. These impacts include structural failure and loss of facility functionality (e.g. damaged police station will no longer be able to serve the community). A complete list of all of the critical facilities, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings for the entire county is listed in Table 4-9. The buildings within the county can all expect the same impacts, similar to those discussed for critical facilities. These impacts include structural failure and loss of building function which could result in indirect impacts (e.g. damaged homes will no longer be habitable causing residence to seek shelter).

Infrastructure

During an earthquake the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since an extensive inventory of the infrastructure is not available to this plan it is important to emphasize that any number of these items could become damaged in the event of a flood. The impacts to these items include broken, failed or impassable roadways, broken or failed utility lines (e.g. loss of power or gas to community), and railway failure from broken or impassable railways. Bridges could fail or become impassable causing risk to traffic. Typical scenarios are described below to gauge the anticipated impacts of earthquakes in the county in terms of numbers and types of buildings and infrastructure.

The Polis team contacted the Indiana Geological Survey (IGS) to obtain existing geological information. Four earthquake scenarios—two based on deterministic scenarios and two based on probabilistic scenarios—were developed to provide a reasonable basis for earthquake planning in Jasper County. The first deterministic scenario was a Moment Magnitude of 5.5 with the epicenter located in Jasper County. Note that a deterministic scenario, in this context, refers to hazard or risk models based on specific scenarios without explicit consideration of the probability of their occurrences. This scenario was selected based upon the opinion of the Indiana Geological Survey (IGS) stating it could occur in the selected location and that it would therefore represent a realistic scenario for planning purposes.

The second deterministic scenario was a 7.1 magnitude epicenter along the Wabash Valley fault zone. Shake maps provided by FEMA were used in HAZUS-MH to estimate losses for Jasper County based on this event.

Additionally, the analysis included two different types of probabilistic scenarios. These types of scenarios are based on ground shaking parameters derived from U.S. Geological Survey probabilistic seismic hazard curves. The first probabilistic scenario was a 500-year return period scenario. This scenario evaluates the average impacts of a multitude of possible earthquake epicenters with a magnitude that would be typical of that expected for a 500-year return period. The second probabilistic scenario allowed calculation of annualized loss. The annualized loss analysis in HAZUS-MH provides a means for averaging potential losses from future scenarios while considering their probabilities of occurrence. The HAZUS-MH earthquake model evaluates eight different return period scenarios including those for the 100-, 250-, 500-, 750-, 1000-, 1500-, 2000-, and 2500-year return period earthquake events. HAZUS-MH then calculates the probabilities of these events as well as the interim events, calculates their associated losses, and sums these losses to calculate an annualized loss. These analysis options were chosen because they are useful for prioritization of seismic reduction measures and for simulating mitigation strategies.

Modeling a deterministic scenario requires user input for a variety of parameters. One of the most critical sources of information that is required for accurate assessment of earthquake risk is soils data. Fortunately, a NEHRP (National Earthquake Hazards Reduction Program) soil classification map exists for Indiana. NEHRP soil classifications portray the degree of shear-wave amplification that can occur during ground shaking. The IGS supplied soils map was used for the analysis.

FEMA provided a map for liquefaction potential that was used by HAZUS-MH. Low lying areas in flood planes with a water table within five feet of grade are susceptible to liquefaction. These areas contain Class F soil types. For the analysis a depth to water table of five meters was used.

An earthquake depth of 10.0 kilometers was selected based on input from IGS. HAZUS-MH also requires the user to define an attenuation function unless ground motion maps are supplied. Because Jasper County has experienced smaller earthquakes, the decision was made to use the Toro et al. (1997) attenuation function. The probabilistic return period analysis and the annualized loss analysis do not require user input.

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

Results for 7.1 Magnitude Earthquake Wabash Valley Scenario

The results of the 7.1 Wabash Valley earthquake are depicted in Table 4-25, Table 4-26, and Figure 4-13. HAZUS-MH estimates that approximately 338 buildings will be at least moderately damaged. This is more than 3% of the total number of buildings in the region. It is estimated that 333 buildings will be damaged beyond repair.

The total building related losses totaled $139.2 million; 4% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies, which made up more than 70% of the total loss.

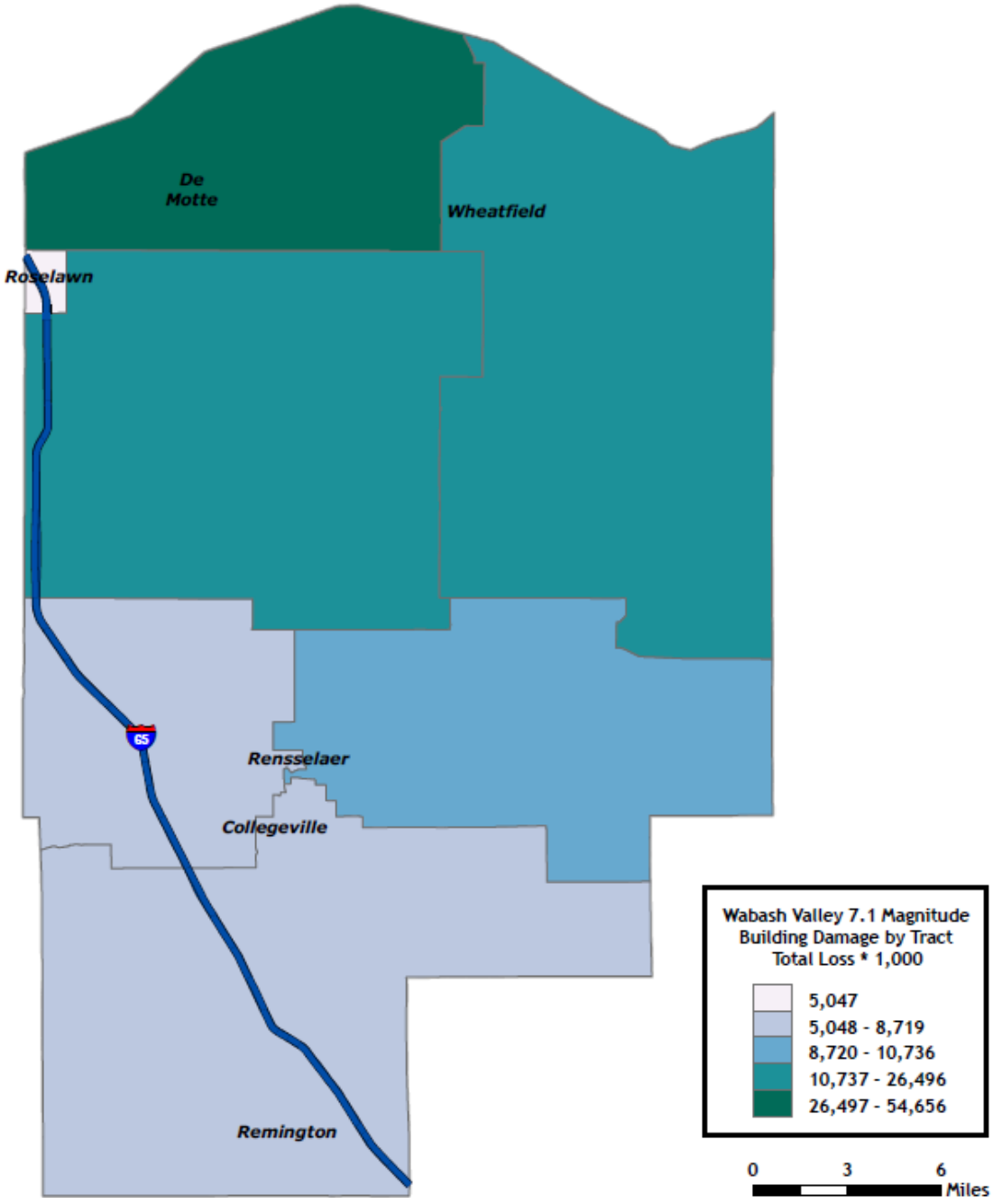
Table 4-25: Wabash Valley Scenario-Damage Counts by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	19	0.19	0	0.30	0	0.40	0	0.16	1	0.16
Commercial	173	1.68	2	2.37	0	2.80	0	1.20	4	1.20
Education	7	0.07	0	0.13	0	0.15	0	0.04	0	0.04
Government	11	0.10	0	0.17	0	0.20	0	0.06	0	0.06
Industrial	42	0.40	0	0.47	0	0.60	0	0.31	1	0.31
Other Residential	1,016	9.86	22	31.25	1	28.87	0	12.36	41	12.36
Religion	20	0.20	0	0.34	0	0.41	0	0.16	1	0.16
Single Family	9,018	87.51	45	64.97	3	66.57	1	85.70	286	85.70
Total	**10,305**		**69**		**4**		**1**		**334**	

Table 4-26: Wabash Valley Scenario-Building Economic losses in Millions of Dollars

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.18	1.02	0.06	0.10	1.36
	Capital-Related	0.00	0.08	0.90	0.04	0.04	1.05
	Rental	1.46	0.46	0.49	0.01	0.04	2.47
	Relocation	0.17	0.01	0.03	0.00	0.02	0.22
	Subtotal	**1.63**	**0.73**	**2.44**	**0.11**	**0.20**	**5.10**
Capital Stock Loses							
	Structural	10.31	0.88	1.51	0.27	0.90	13.88
	Non_Structural	50.05	8.31	11.94	3.66	4.63	78.58
	Content	21.80	3.16	9.07	2.61	3.75	40.39
	Inventory	0.00	0.00	0.36	0.67	0.23	1.26
	Subtotal	**82.16**	**12.36**	**22.88**	**7.21**	**9.50**	**134.10**
	Total	**83.79**	**13.09**	**25.31**	**7.32**	**9.70**	**139.20**

Figure 4-13: Wabash Valley Scenario-Building Economic Losses in Thousands of Dollars



Wabash Valley Scenario—Essential Facility Losses

Before the earthquake, the region had 66 care beds available for use. On the day of the earthquake, the model estimates that only 64 care beds (98%) are available for use by patients already in medical care facilities and those injured by the earthquake. After one week, 100% of the beds will be back in service. By day 30, 100% will be operational.

Results for 5.5 Magnitude Earthquake in Jasper County

The results of the initial analysis, the 5.5 magnitude earthquake with an epicenter in the center of Jasper County, are depicted in Tables 4-27 and 4-28 and Figure 4-14. HAZUS-MH estimates that approximately 1,122 buildings will be at least moderately damaged. This is more than 100% of the total number of buildings in the region. It is estimated that 82 buildings will be damaged beyond repair.

The total building related losses totaled $106.2 million; 9% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies, which comprised more than 64% of the total loss.

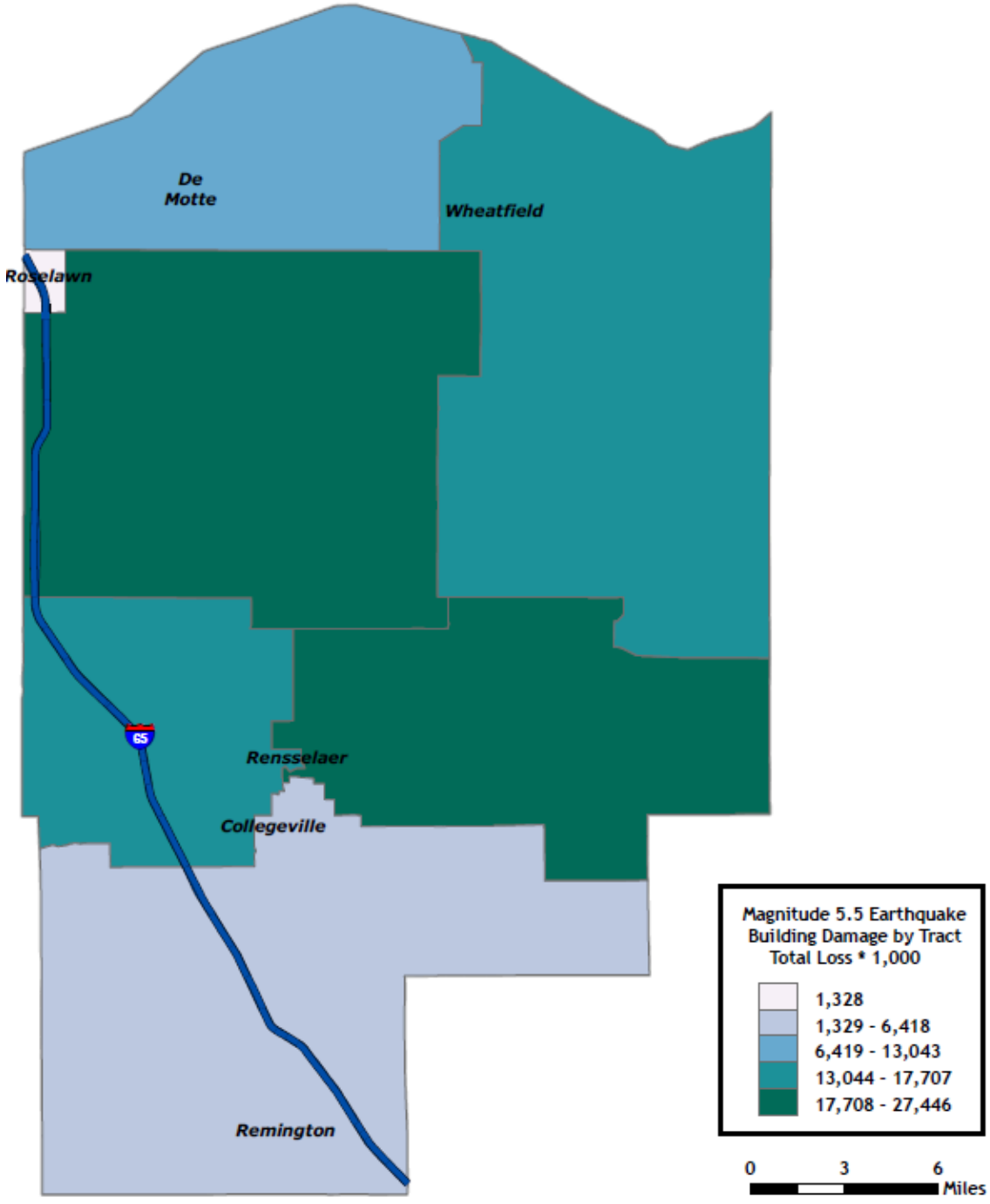
Table 4-27: Jasper County 5.5M Scenario-Damage Counts by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	12	0.16	4	0.18	3	0.35	1	0.53	0	0.29
Commercial	117	1.53	32	1.65	22	2.58	7	3.46	1	1.56
Education	4	0.06	1	0.07	1	0.12	0	0.16	0	0.12
Government	7	0.10	2	0.09	1	0.15	0	0.18	0	0.12
Industrial	27	0.35	7	0.38	6	0.73	2	1.07	0	0.43
Other Residential	693	9.09	212	10.78	149	17.49	22	11.37	5	6.05
Religion	14	0.18	4	0.19	2	0.29	1	0.41	0	0.24
Single Family	6,751	88.53	1,703	86.66	665	78.29	157	82.82	76	91.19
Total	**7,626**		**1,965**		**850**		**189**		**83**	

Table 4-28: Jasper County 5.5M Scenario-Building Economic Losses in Millions of Dollars

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	12	0.16	4	0.18	3	0.35	1	0.53	0	0.29
Commercial	117	1.53	32	1.65	22	2.58	7	3.46	1	1.56
Education	4	0.06	1	0.07	1	0.12	0	0.16	0	0.12
Government	7	0.10	2	0.09	1	0.15	0	0.18	0	0.12
Industrial	27	0.35	7	0.38	6	0.73	2	1.07	0	0.43
Other Residential	693	9.09	212	10.78	149	17.49	22	11.37	5	6.05
Religion	14	0.18	4	0.19	2	0.29	1	0.41	0	0.24
Single Family	6,751	88.53	1,703	86.66	665	78.29	157	82.82	76	91.19
Total	**7,626**		**1,965**		**850**		**189**		**83**	

Figure 4-14: Jasper County 5.5M Scenario-Building Economic Losses in Thousands of Dollars



Jasper County 5.5M Scenario—Essential Facility Losses

Before the earthquake, the region had 66 care beds available for use. On the day of the earthquake, the model estimates that only 32 care beds (49%) are available for use by patients already in medical care facilities and those injured by the earthquake. After one week, 65% of the beds will be back in service. By day 30, 88% will be operational.

Results 5.0 Magnitude 500-Year Probabilistic Scenario

The results of the 500-year probabilistic analysis are depicted in Table 4-29, Table 4-30, and Figure 4-17. HAZUS-MH estimates that approximately 116 buildings will be at least moderately damaged. This is more than 1% of the total number of buildings in the region. It is estimated that one building will be damaged beyond repair.

The total building-related losses totaled $5.2 million; 20% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies, which made up more than 55% of the total loss.

Table 4-29: 500-Year Probabilistic Scenario-Damage Counts by Building Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	18	0.18	1	0.31	0	0.45	0	0.59	0	0.35
Commercial	166	1.62	9	2.65	4	3.41	1	4.34	0	2.94
Education	6	0.06	0	0.11	0	0.14	0	0.18	0	0.19
Government	10	0.10	1	0.15	0	0.19	0	0.22	0	0.23
Industrial	40	0.39	2	0.62	1	0.87	0	1.09	0	0.48
Other Residential	982	9.59	69	19.79	27	26.27	1	9.01	0	3.72
Religion	19	0.19	1	0.30	0	0.41	0	0.55	0	0.48
Single Family	9,003	87.88	267	76.09	70	68.26	11	84.03	1	91.61
Total	**10,245**		**351**		**103**		**13**		**1**	

Table 4-30: 500-Year Probabilistic Scenario-Building Economic Losses in Millions of Dollars

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.02	0.31	0.01	0.03	0.37
	Capital-Related	0.00	0.01	0.26	0.01	0.01	0.28
	Rental	0.10	0.07	0.19	0.01	0.01	0.37
	Relocation	0.01	0.00	0.01	0.00	0.00	0.03
	Subtotal	**0.11**	**0.10**	**0.76**	**0.03**	**0.05**	**1.05**
Capital Stock Losses							
	Structural	0.64	0.15	0.32	0.06	0.18	1.35
	Non_Structural	1.33	0.32	0.42	0.08	0.16	2.31
	Content	0.23	0.05	0.16	0.05	0.06	0.54
	Inventory	0.00	0.00	0.01	0.01	0.00	0.02
	Subtotal	**2.21**	**0.51**	**0.90**	**0.20**	**0.40**	**4.23**
	Total	**2.32**	**0.61**	**1.67**	**0.23**	**0.46**	**5.28**

500-Year Probabilistic Scenario—Essential Facility Losses

Before the earthquake, the region had 66 care beds available for use. On the day of the earthquake, the model estimates that only 58 care beds (89%) are available for use by patients already in medical care facilities and those injured by the earthquake. After one week, 95% of the beds will be back in service. By day 30, 99% will be operational.

Results Annualized Risk Scenario

HAZUS-MH estimates that approximately 83 buildings will be at least moderately damaged. This is more than 1% of the total number of buildings in the region. It is estimated that no buildings will be damaged beyond repair.

Vulnerability to Future Assets/Infrastructure for Earthquake Hazard

New construction, especially critical facilities, will accommodate earthquake mitigation design standards.

Analysis of Community Development Trends

Community development will occur outside of the low lying areas in flood planes with a water table within five feet of grade which are susceptible to liquefaction. As natural hazards and man-initiated events with hazardous consequences occur, and they will, a hardened emergency operations center and evacuation facility need to be built to help minimize the consequences of the disaster and hasten the recovery from the event.

4.4.4 Thunderstorm Hazard

Hazard Definition for Thunderstorm Hazard

Severe thunderstorms are defined as thunderstorms including one or more of the following characteristics: strong winds, large damaging hail, or frequent lightning. Severe thunderstorms most frequently occur in Indiana during the spring and summer months, but can occur any month of the year at any time of day. A severe thunderstorm's impacts can be localized or can be widespread in nature. A thunderstorm is classified as severe when it meets one or more of the following criteria.

- Hail of diameter 0.75 inches or higher.
- Frequent and dangerous lightning.
- Wind speeds equal to or greater than 58 mph.

Hail

Hail is a product of a strong thunderstorm. Hail usually falls near the center of a storm, however strong winds occurring at high altitudes in the thunderstorm can blow the hailstones away from the storm center, resulting in damage in other areas near the storm. Hailstones range from pea-sized to baseball-sized, but hailstones larger than softballs have been reported on rare occasion.

Lightning

Lightning is a discharge of electricity from a thunderstorm. Lightning is often perceived as a minor hazard, but in reality lightning causes damage to many structures and kills or severely injures numerous people in the United States each year.

Severe Winds (Straight-Line Winds)

Straight-line winds from thunderstorms are a fairly common occurrence across Indiana. Straight-line winds can cause damage to homes, businesses, power lines, and agricultural areas, and may require temporary sheltering of individuals who are without power for extended periods of time.

Previous Occurrences for Thunderstorm Hazard

The National Climatic Data Center (NCDC) database reported 25 hailstorms in Jasper County since 1950. Hailstorms occur nearly every year in the last spring and early summer months. The most recent significant occurrence was in the evening on April 14, 2006 when 1.75 inch hail fell in the region.

The Jasper County hailstorms are identified in Table 4-31. Additional details for NCDC events are included in Appendix D.

Table 4-31: Jasper County Hailstorms*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Jasper	5/12/1970	Hail	1.75 in.	0	0	0	0
Jasper	6/8/1981	Hail	1.00 in.	0	0	0	0
Jasper	8/6/1985	Hail	1.75 in.	0	0	0	0
Jasper	6/2/1987	Hail	1.75 in.	0	0	0	0
Jasper	5/15/1988	Hail	1.75 in.	0	0	0	0
Jasper	8/28/1990	Hail	1.75 in.	0	0	0	0
Jasper	7/7/1991	Hail	1.75 in.	0	0	0	0
Jasper	4/26/1994	Hail	0.75 in.	0	0	0	0
Wheatfield	12/6/1998	Hail	0.75 in.	0	0	0	0
Rensselaer	4/9/2001	Hail	1.00 in.	0	0	0	0
Remington	7/4/2003	Hail	1.75 in.	0	0	0	0
Rensselaer	7/11/2003	Hail	0.88 in.	0	0	0	0
Rensselaer	7/21/2003	Hail	0.88 in.	0	0	0	0
Wheatfield	7/21/2003	Hail	1.75 in.	0	0	0	0
Rensselaer	8/2/2003	Hail	0.88 in.	0	0	0	0
Rensselaer	5/18/2004	Hail	1.25 in.	0	0	0	0
Remington	5/18/2004	Hail	1.00 in.	0	0	0	0
Rensselaer	7/21/2004	Hail	1.00 in.	0	0	0	0
Remington	7/21/2004	Hail	0.75 in.	0	0	0	0
Remington	4/14/2006	Hail	1.75 in.	0	0	0	0
Rensselaer	4/14/2006	Hail	0.88 in.	0	0	0	0
Remington	4/14/2006	Hail	1.75 in.	0	0	0	0
Rensselaer	5/24/2006	Hail	1.00 in.	0	0	0	0
Demotte	10/18/2007	Hail	1.00 in.	0	0	0K	0K

* NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

The National Climatic Data Center (NCDC) database reported zero occurrences of significant lightning strikes in Jasper County since 1950. However, lightning occurs in Jasper County every year.

The National Climatic Data Center (NCDC) database identified 62 wind storms reported since 1950. On multiple occasions in the past 50 years, Jasper County wind storms have uprooted trees in their severity. Many of the displaced trees landed on homes and automobiles. In addition, several of these extreme wind events resulted in damage to multiple buildings unable to withstand the force produced by the wind speeds.

As shown in Table 4-32, wind storms have historically occurred year-round with the greatest frequency and damage in April through August. The following table includes available top wind speeds for Jasper County.

Table 4-32: Jasper County Wind Storms*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Jasper	5/21/1956	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	6/8/1958	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	6/8/1958	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	8/15/1958	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	10/7/1962	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	6/20/1974	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	6/20/1974	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	6/15/1976	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	6/15/1976	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	7/28/1976	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	8/16/1978	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	6/8/1979	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	7/5/1980	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	9/26/1981	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	4/3/1982	Thunderstorm Winds	56 kts.	0	0	0	0
Jasper	4/3/1982	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	7/1/1983	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	7/19/1983	Thunderstorm Winds	61 kts.	0	0	0	0
Jasper	11/19/1985	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	8/18/1988	Thunderstorm Winds	61 kts.	0	0	0	0
Jasper	11/16/1988	Thunderstorm Winds	61 kts.	0	0	0	0
Jasper	7/2/1992	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	7/2/1992	Thunderstorm Winds	61 kts.	0	0	0	0
Jasper	9/7/1992	Thunderstorm Winds	0 kts.	0	0	0	0
Rensselaer	4/26/1994	Thunderstorm Winds	0 kts.	0	0	0	0
Jasper	11/21/1994	High Wind	0 kts.	0	0	50K	0
Jasper	11/27/1994	High Wind	0 kts.	0	0	120K	0
Remington	1/18/1996	Thunderstorm Winds	0 kts.	0	0	0	0
Rensselaer Jasper	1/18/1996	Thunderstorm Winds	52 kts.	0	0	0	0
Jasper	3/25/1996	High Wind	46 kts.	0	0	0	0
Jasper	10/29/1996	Thunderstorm Winds	0 kts.	0	0	0	0
Rensselaer	4/30/1997	Thunderstorm Winds	0 kts.	0	2	0	0
Fair Oaks	6/30/1997	Thunderstorm Winds	50 kts.	0	0	0	0
Jasper	11/10/1998	High Wind	50 kts.	0	0	0	0
Rensselaer	6/11/1999	Thunderstorm Winds	61 kts.	0	0	0	0
Rensselaer	5/9/2000	Thunderstorm Winds	50 kts.	0	0	0	0

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Kniman	5/18/2000	Thunderstorm Winds	60 kts.	0	0	0	0
Rensselaer	5/31/2000	Thunderstorm Winds	50 kts.	0	0	0	0
Wheatfield	9/11/2000	Thunderstorm Winds	50 kts.	0	0	0	0
Jasper	2/25/2001	Strong Wind	0 kts.	0	0	0	0
Rensselaer	6/12/2001	Thunderstorm Winds	50 kts.	0	0	0	0
Rensselaer	7/22/2001	Thunderstorm Winds	52 kts.	0	0	0	0
Jasper	3/9/2002	High Wind	51 kts.	0	0	0	0
Tefft	4/4/2003	Thunderstorm Winds	55 kts.	0	0	0	0
Demotte	7/7/2003	Thunderstorm Winds	52 kts.	0	0	0	0
Demotte	7/27/2003	Thunderstorm Winds	52 kts.	0	0	0	0
Lewiston	7/27/2003	Thunderstorm Winds	57 kts.	0	0	0	0
Rensselaer	8/2/2003	Thunderstorm Winds	52 kts.	0	0	0	0
Jasper	11/13/2003	High Wind	52 kts.	0	0	0	0
Remington	5/7/2004	Thunderstorm Winds	70 kts.	0	0	0	0
Wheatfield	5/30/2004	Thunderstorm Winds	50 kts.	0	0	0	0
Remington	5/30/2004	Thunderstorm Winds	55 kts.	0	0	0	0
Wheatfield	5/30/2004	Thunderstorm Winds	55 kts.	0	0	0	0
Wheatfield	7/21/2004	Thunderstorm Winds	50 kts.	0	0	0	0
Demotte	7/22/2004	Thunderstorm Winds	50 kts.	0	0	0	0
Jasper	6/5/2005	Thunderstorm Winds	55 kts.	0	0	0	0
Wheatfield	6/5/2005	Thunderstorm Winds	55 kts.	0	0	0	0
Rensselaer	6/5/2005	Thunderstorm Winds	50 kts.	0	0	0	0
Rensselaer	7/3/2006	Thunderstorm Winds	50 kts.	0	0	0	0
Wheatfield	8/23/2006	Thunderstorm Winds	55 kts.	0	0	0	0
Remington	3/23/2007	Heavy Rain	N/A	0	0	0K	0K
Wheatfield	7/18/2007	Thunderstorm Wind	50 kts.	0	0	5K	0K

* NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

Geographic Location for Thunderstorm Hazard

The entire county has the same risk for occurrence of thunderstorms. They can occur at any location within the county.

Hazard Extent for Thunderstorm Hazard

The extent of the historical thunderstorms varies in terms of the extent of the storm, the wind speed, and the size of hail stones. Thunderstorms can occur at any location within the county.

Calculated Priority Risk Index for Thunderstorm Hazard

Based on historical information, the probability of future high wind damage is highly likely. High winds with widely varying magnitudes are expected to happen. According to the CPRI, thunderstorms, high wind, hail and lightning damage ranked as the number two hazard along with tornadoes.

CPRI = Probability X .45 + Magnitude/Severity X .30 + Warning Time X .15 + Duration of event X .10.

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
4 x .45	+	**2** x .30	+	**4** x .15	+	**1** x .10	=	**3.1**

Vulnerability Analysis for Thunderstorm Hazard

Severe thunderstorms are an equally distributed threat across the entire jurisdiction; therefore, the entire county's population and all buildings are vulnerable to a severe thunderstorm and can expect the same impacts within the affected area. This plan will therefore consider all buildings located within the county as vulnerable. The existing buildings in Jasper County are discussed in Table 4-9.

Critical Facilities

All critical facilities are vulnerable to severe thunderstorms. A critical facility will encounter many of the same impacts as any other building within the jurisdiction. These impacts include structural failure, debris (trees or limbs) causing damage, roofs blown off or windows broken by hail or high winds, fires caused by lightning and loss of function of the facility (e.g. damaged police station will no longer be able to serve the community). Table 4-8 lists the types and numbers of all of the essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings for the entire county is provided in Table 4-9. The buildings within the county can all expect the same impacts, similar to those discussed for critical facilities. These impacts include structural failure, debris (trees or limbs) causing damage, roofs blown off or windows broken by hail or high winds, fires caused by lightning, and loss of building functionality (e.g. damaged home will no longer be habitable causing residence to seek shelter).

Infrastructure

During a severe thunderstorm the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is

equally vulnerable it is important to emphasize that any number of these items could become damaged during a severe thunderstorm. The impacts to these items include broken, failed, or impassable roadways; broken or failed utility lines (e.g. loss of power or gas to community); or railway failure from broken or impassable railways. Bridges could fail or become impassable causing risk to traffic.

Vulnerability to Future Assets/Infrastructure for Thunderstorm Hazard

All future development within the county and all communities will remain vulnerable to these events.

Analysis of Community Development Trends

Preparing for severe storms will be enhanced if officials sponsor a wide range of programs and initiatives to address the overall safety of county residents. New structures need to be built with more sturdy construction, and those structures already in place need to be hardened to lessen the potential impacts of severe weather. Community warning sirens to provide warning of approaching storms are also vital to preventing the loss of property and ensuring the safety of Jasper County residents. As natural hazards and man-initiated events with hazardous consequences occur, and they will, a hardened emergency operations center and evacuation facility need to be built to help minimize the consequences of the disaster and hasten the recovery from the event.

4.4.5 Drought Hazard

Hazard Definition for Drought Hazard

Drought is a climatic phenomenon that occurs in Jasper County. The meteorological condition that creates a drought is below normal rainfall. However, excessive heat can lead to increased evaporation, which will enhance drought conditions. Droughts can occur in any month. Drought differs from normal arid conditions found in low rainfall areas. Drought is the consequence of a reduction in the amount of precipitation over an undetermined length of time (usually a growing season or more).

The severity of a drought depends on location, duration, and geographical extent. Additionally, drought severity depends on the water supply, usage demands made by human activities, vegetation, and agricultural operations. Drought brings several different problems that must be addressed. The quality and quantity of crops, livestock, and other agricultural assets will be affected during a drought. Drought can adversely impact forested areas leading to an increased potential for extremely destructive forest and woodland fires that could threaten residential, commercial, and recreational structures.

Previous Occurrences for Drought Hazard

The National Climatic Data Center (NCDC) database reported two drought/heat wave events in Jasper County since 1950. For example, both occurred in 1995 when most of Indiana was in extreme drought status.
Source: CEMP

NCDC records of droughts/heat waves are identified in Table 4-33. Additional details for NCDC events are included in Appendix D.

Table 4-33: Jasper County Drought/Heat Wave Events*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Jasper	7/13/1995	Heat Wave	N/A	14	0	1.0M	0
Jasper	8/21/1995	Heat Wave	N/A	1	0	0	0

* NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

Geographic Location for Drought Hazard

Droughts are regional in nature. Most of the NCDC data is calculated regionally or in some cases statewide.

Hazard Extent for Drought Hazard

The extent of the droughts varies both in terms of the extent of the heat and the range of precipitation.

Calculated Priority Risk Index for Drought Hazard

Based on historical information, future droughts in Jasper County are possible. Droughts of varying magnitudes are expected to happen. According to the CPRI, droughts ranked as the number six hazard.

CPRI = Probability X .45 + Magnitude/Severity X .30 + Warning Time X .15 + Duration of event X .10.

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
2 x .45	+	**2** x .30	+	**1** x .15	+	**4** x .10	=	**2.05**

Vulnerability Analysis for Drought Hazard

Drought impacts are an equally distributed threat across the entire jurisdiction; therefore, the county is vulnerable to a drought and can expect the same impacts within the affected area. The entire population and all buildings have been identified as at risk. The building exposure for Jasper County, as determined from the updated inventory in HAZUS-MH is included in Table 4-9.

Critical Facilities

All critical facilities are vulnerable to drought. A critical facility will encounter many of the same impacts as any other building within the jurisdiction, which should involve only minor damage. These impacts include water shortages, fires as a result of drought conditions, and residents in need of medical care from the heat and dry weather. Table 4-8 lists the types and numbers of all of the essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings for the entire county is listed in Table 4-9. The buildings within the county can all expect the same impacts similar to those discussed for critical facilities. These impacts include water shortages, fires as a result of drought conditions, and residents in need of medical care from the heat and dry weather.

Infrastructure

During a drought the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. The risk to these structures is primarily associated with a fire that could result from the hot, dry conditions. Since the county's entire infrastructure is equally

vulnerable, it is important to emphasize that any number of these items could become damaged during a heat wave. The impacts to these items include broken, failed, or impassable roadways; broken or failed utility lines (e.g. loss of power or gas to community); or railway failure from broken or impassable railways. Bridges could fail or become impassable causing risk to traffic.

Vulnerability to Future Assets/Infrastructure for Drought Hazard

Future development will remain vulnerable to these events. According to the Jasper County CEMP, some urban and rural areas are more susceptible than others. Urban areas are subject to water shortages during periods of drought. Excessive demands of the populated area place a limit on water resources. In rural areas, crops and livestock may suffer from extended periods of heat and drought. Dry conditions can lead to the ignition of wildfires that could threaten residential, commercial, and recreational areas.

Analysis of Community Development Trends

Because the droughts are regional in nature future development will be impacted across the county.

4.4.6 Winter Storm Hazard

Hazard Definition for Winter Storm Hazard

Severe winter weather consists of various forms of precipitation and strong weather conditions. This may include one or more of the following: freezing rain, sleet, heavy snow, blizzards, icy roadways, extreme low temperatures, and strong winds. These conditions can cause human health risks such as frostbite, hypothermia, and death.

Ice (glazing) and Sleet Storms

Ice or sleet, even in the smallest quantities, can result in hazardous driving conditions and can be a significant cause of property damage. Sleet can be easily identified as frozen raindrops. Sleet does not stick to trees and wires. The most damaging winter storms in Indiana have been ice storms. Ice storms are the result of cold rain that freezes on contact with objects having a temperature below freezing. Ice storms occur when moisture-laden gulf air converges with the northern jet stream causing strong winds and heavy precipitation. This precipitation takes the form of freezing rain coating power lines, communication lines, and trees with heavy ice. The winds will then cause the overburdened limbs and cables to snap; leaving large sectors of the population without power, heat, or communication. Falling trees and limbs can also cause building damage during an ice storm. In the past few decades numerous ice storm events have occurred in Indiana.

Snowstorms

Significant snowstorms are characterized by the rapid accumulation of snow, often accompanied by high winds, cold temperatures, and low visibility. A blizzard is categorized as a snowstorm with winds of 35 miles per hour or greater and/or visibility of less than ¼ mile for three or more hours. The strong winds during a blizzard blow falling and already existing snow, create poor visibility and impassable roadways. Blizzards have the potential to result in property damage.

Indiana has repeatedly been struck by blizzards. Blizzard conditions can not only cause power outages and loss of communication, but also make transportation difficult. The blowing of snow can make visibility less than ¼ mile, but the resulting disorientation makes even travel by foot dangerous if not deadly.

Severe Cold

Severe cold is characterized by the ambient air temperature dropping to around 0˚F or below. These extreme temperatures can increase the likelihood of frostbite and hyperthermia. High winds during severe cold events can enhance the air temperature's affects. Fast winds during cold weather events can lower the wind chill factor (how cold the air feels on your skin). As a result, the time it takes for frostbite and hypothermia to affect a person's body will decrease.

Previous Occurrences for Winter Storm Hazard

The National Climatic Data Center (NCDC) database identified 31 winter storm and extreme

cold events for Jasper County since 1950. In January of 2008, a strong cold front moved across northwest Indiana during the afternoon hours of January 29. Thunderstorms developed ahead of this front with temperatures in the 40s and lower 50s. Temperatures quickly dropped into the teens behind the front. During the evening hours, an area of heavy snow developed across northwest Indiana. This heavy snow combined with winds gusting to 35 mph to cause near blizzard conditions with numerous locations reporting visibility less than a quarter mile. Snowfall amounts were generally between one and three inches but were difficult to measure due to the strong winds. Wind chills ranged from -15°F to -25°F for most of the night.
Source: CEMP

The NCDC winter storms are listed in Table 4-34. Additional details for NCDC events are included in Appendix D.

Table 4-34: Winter Storm Events*

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Jasper	2/15/1993	Heavy Snow	N/A	0	0	50K	0
Jasper	2/22/1993	Heavy Snow	N/A	0	0	50K	0
Jasper	2/22/1993	Heavy Snow	N/A	0	0	50K	0
Jasper	1/14/1994	Extreme Cold	N/A	3	0	5.0M	0
Jasper	2/25/1994	Heavy Snow/blowing Snow	N/A	0	0	0	0
Jasper	4/10/1995	Ice Storm	N/A	0	0	0	0
Jasper	12/8/1995	Winter Storm	N/A	0	0	0	0
Jasper	12/18/1995	Winter Storm	N/A	0	0	0	0
Jasper	2/2/1996	Extreme Cold	N/A	0	0	0	0
Jasper	1/9/1997	Winter Storm	N/A	0	0	0	0
Jasper	1/15/1997	Winter Storm	N/A	0	0	0	0
Jasper	3/9/1998	Heavy Snow	N/A	0	0	0	0
Jasper	1/1/1999	Heavy Snow	N/A	0	0	0	0
Jasper	3/8/1999	Heavy Snow	N/A	0	0	0	0
Jasper	1/19/2000	Heavy Snow	N/A	0	0	0	0
Jasper	12/11/2000	Winter Storm	N/A	0	0	0	0
Jasper	2/26/2002	Winter Storm	N/A	0	0	0	0
Jasper	12/24/2002	Winter Storm	N/A	0	0	0	0
Jasper	1/17/2003	Heavy Snow	N/A	0	0	0	0
Jasper	1/23/2003	Extreme Cold/wind Chill	N/A	0	0	0	0
Jasper	2/14/2003	Winter Storm	N/A	0	0	0	0
Jasper	1/29/2004	Extreme Cold/wind Chill	N/A	0	0	0	0
Jasper	5/3/2004	Frost/freeze	N/A	0	0	0	0
Jasper	1/21/2005	Heavy Snow	N/A	0	0	0	0
Jasper	12/8/2005	Winter Storm	N/A	0	0	0	0
Jasper	2/13/2007	Blizzard	N/A	0	0	0K	0K
Jasper	12/9/2007	Ice Storm	N/A	0	0	0K	0K
Jasper	1/29/2008	Winter Storm	N/A	0	0	0K	0K

Location or County	Date	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Jasper	1/31/2008	Winter Storm	N/A	0	0	0K	0K
Jasper	2/1/2008	Winter Storm	N/A	0	0	0K	0K
Jasper	2/25/2008	Winter Storm	N/A	0	0	0K	0K

* NCDC records are estimates of damage compiled by the National Weather Service from various local, state, and federal sources. However, these estimates are often preliminary in nature and may not match the final assessment of economic and property losses related to a given weather event.

Geographic Location for Winter Storm Hazard

Severe winter storms are regional in nature. Most of the NCDC data is calculated regionally or in some cases statewide.

Hazard Extent for Winter Storm Hazard

The extent of the historical winter storms varies in terms of storm location, temperature, and ice or snowfall. A severe winter storm can occur anywhere in the jurisdiction.

Calculated Priority Risk Index for Winter Storm Hazard

Based on historical information, the probability of future winter storms is highly likely. Winter storms of varying magnitudes are expected to happen. According to the CPRI, winter storms ranked as the number three hazard.

CPRI = Probability X .45 + Magnitude/Severity X .30 + Warning Time X .15 + Duration of event X .10.

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
4 x .45	+	**1** x .30	+	**3** x .15	+	**3** x .10	=	**2.85**

Vulnerability Analysis for Winter Storm Hazard

Winter storm impacts are equally distributed across the entire jurisdiction; therefore, the entire county is vulnerable to a winter storm and can expect the same impacts within the affected area. The building exposure for Jasper County, as determined from the building inventory, is included in Table 4-9.

Critical Facilities

All critical facilities are vulnerable to a winter storm. A critical facility will encounter many of the same impacts as other buildings within the jurisdiction. These impacts include loss of gas or electricity from broken or damaged utility lines, damaged or impassable roads and railways, broken water pipes, and roof collapse from heavy snow. Table 4-8 lists the types and numbers of

the essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings for the entire county is listed in Table 4-9. The impacts to the general buildings within the county are similar to the damages expected to the critical facilities. These include loss of gas of electricity from broken or damaged utility lines, damaged or impassable roads and railways, broken water pipes, and roof collapse from heavy snow.

Infrastructure

During a winter storm the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable it is important to emphasize that any number of these items could become damaged during a winter storm. Potential impacts include broken gas and/or electricity lines or damaged utility lines, damaged or impassable roads and railways, and broken water pipes.

Vulnerability to Future Assets/Infrastructure for Winter Storm Hazard

Any new development within the county will remain vulnerable to these events.

Analysis of Community Development Trends

Because the winter storm events are regional in nature future development will be equally impacted across the county.

4.4.7 Hazardous Materials Storage and Transport Hazard

Hazard Definition for Hazardous Materials Storage and Transport Hazard

The State of Indiana has numerous active transportation lines that run through many of the counties in the state. Active railways transport harmful and volatile substances between our borders every day. The transportation of chemicals and substances along interstate routes is commonplace in Indiana. The rural areas of Indiana have considerable agricultural commerce creating a demand for fertilizers, herbicides, and pesticides to be transported along rural roads. Finally, Indiana is bordered by two major rivers and Lake Michigan. Barges transport chemicals and substances along these waterways daily. These factors increase the chance of hazardous material releases and spills throughout the State of Indiana.

The release or spill of certain substances can cause an explosion. Explosions result from the ignition of volatile products such as petroleum products, natural and other flammable gases, hazardous materials/chemicals, dust, and bombs. An explosion can potentially cause death, injury, and property damage. In addition, a fire routinely follows an explosion which may cause further damage and inhibit emergency response. Emergency response may require fire, safety/law enforcement, search and rescue, and hazardous materials units.

Previous Occurrences for Hazardous Materials Storage and Transport Hazard

Jasper County has not experienced a significantly large-scale hazardous material incident at fixed sites or during transport that have resulted in multiple deaths or serious injuries. There have been many minor releases that have put local firefighters, hazardous materials teams, emergency management, and local law enforcement into action to try to stabilize these incidents to prevent or lessen harm to Jasper County residents. Table 4-35 lists the major releases within the county from 1991 to 2003 as provided in the CEMP report.

Table 4-35: Significant Hazmat Releases in Jasper County

Date	Location	Characteristics of Event
	Interstate 65	The interstate was closed for 5–6 hours after a hazardous material spilled from a Federal Express truck.
2002	Interstate 65	A tanker spilled concentrated antifreeze shutting down the interstate for 8–10 hours.
2001	State Road 114	A tanker truck leaked argon gas. State road 114 was shut down for 5–6 hours.
1993	Outside Remington	United States Highway 24 was closed for approximately 11 hours after two trucks, one carrying Alaphatic, which contains the chemical naphtha and the other carrying pig manure, collided. The truck carrying Alaphatic leaked 100 gallons of the chemical. The contents of the tanker had to be transferred to another tanker truck to prevent further leakage. No evacuations were ordered.
1991	Remington	Hydrochloric sulfuric acid leaked from a truck at the Central Soya facility while the chemical was being unloaded. Approximately 1,000 gallons spilled. The nearby Carpenter Creek was sandbagged to prevent the spill from entering the waterway. Residences and businesses were evacuated for 4 ½ hours. Only 1 person was treated for inhalation of the chemical, which causes eye and skin irritation.

Geographic Location for Hazardous Materials Storage and Transport Hazard

The hazardous material hazards are countywide and are primarily associated with the transport of materials via highway and railroad.

Hazard Extent for Hazardous Materials Storage and Transport Hazard

The extent of the hazardous material hazard varies both in terms of the quantity of material being transported as well as the specific content of the container.

Calculated Priority Risk Index for Hazardous Materials Storage and Transport Hazard

There is the possibility of a major hazardous material event based on historical information and input from Jasper County EMA. According to the CPRI, Hazardous Materials Storage and Transport ranked as the number four hazard in the county.

CPRI = Probability X .45 + Magnitude/Severity X .30 + Warning Time X .15 + Duration of event X .10.

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
3 x .45	+	**2** x .30	+	**4** x .15	+	**2** x .10	=	**2.75**

Vulnerability Analysis for Hazardous Materials Storage and Transport Hazard

Hazardous material impacts are an equally distributed threat across the entire jurisdiction; therefore, the entire county is vulnerable to a hazardous material release and can expect the same impacts within the affected area. The main concern during a release or spill is the populations affected. The building exposure for Jasper County, as determined from the building inventory, is included in Table 4-9. This plan will therefore consider all buildings located within the county as vulnerable.

Critical Facilities

All critical facilities and communities within the county are at risk. A critical facility, if vulnerable, will encounter many of the same impacts as any other building within the jurisdiction. These impacts include structural failure due to fire or explosion and loss of function of the facility (e.g. a damaged police station will no longer be able to serve the community). Table 4-8 lists the types and numbers of all essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings for the entire county is listed in Table 4-9. The buildings within the county can all expect the same impacts, similar to those discussed for critical facilities. These impacts include structural failure due to fire or explosion or debris and loss of function of the building (e.g. a damaged home will no longer be habitable causing residence to seek shelter).

Infrastructure

During a hazardous material release the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since an extensive inventory of the infrastructure is not available to this plan it is important to emphasize that any number of these items could become damaged in the event of a hazardous material release. The impacts to these items include broken, failed, or impassable roadways; broken or failed utility lines (e.g. loss of power or gas to community); and railway failure from broken or impassable railways. Bridges could fail or become impassable causing risk to traffic.

In terms of numbers and types of buildings and infrastructure, typical scenarios are described as follows to gauge the anticipated impacts of hazardous material release events in the county.

Jasper County Hazardous Material Analysis #1

The U.S. EPA's ALOHA (Areal Locations of Hazardous Atmospheres) model was utilized to assess the area of impact for an anhydrous ammonia release approximately four miles east of Rensselaer at the ethanol plant on SR 114 and County Road 150 W.

Anhydrous ammonia is a clear colorless gas with a strong odor. Contact with the unconfined liquid can cause frostbite. Though the gas is generally regarded as nonflammable, it can burn within certain vapor concentration limits with strong ignition. The fire hazard increases in the presence of oil or other combustible materials. Vapors from an anhydrous ammonia leak initially hug the ground, and prolonged exposure of containers to fire or heat may cause violent rupturing and rocketing. Long-term inhalation of low concentrations of the vapors or short-term inhalation of high concentrations has adverse health effects. Anhydrous ammonia is generally used as a fertilizer, a refrigerant, and in the manufacture of other chemicals.

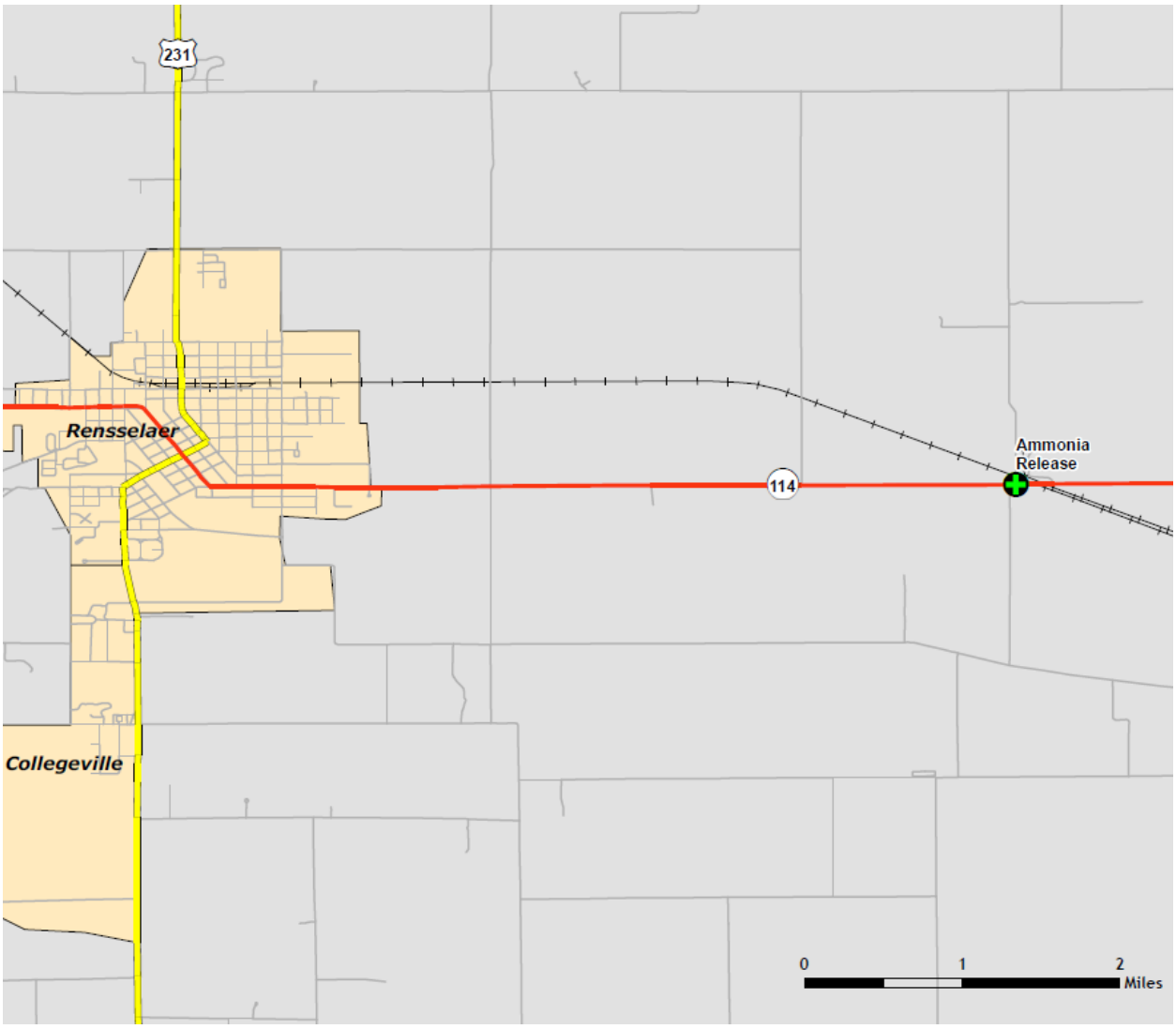
Source: CAMEO

ALOHA is a computer program designed especially for use by people responding to chemical accidents, as well as for emergency planning and training. Anhydrous ammonia is a common chemical used in industrial operations and can be found in either liquid or gas form. Rail and truck tankers commonly haul anhydrous ammonia to and from facilities.

For this scenario, we assumed moderate atmospheric and climatic conditions with a slight breeze from the west.

The geographic area covered in this analysis is depicted in Figure 4-15.

Figure 4-15: Location of Chemical Release



Analysis

The ALOHA atmospheric modeling parameters, depicted in Figure 4-16, were based upon a five mile per hour wind from the west. The temperature was 68°F with 75% humidity and partly cloudy skies.

The source of the chemical spill is a horizontal, cylindrical-shaped tank. The diameter of the tank was set to 10 feet and the length set to 30 feet (17,626 gallons). At the time of its release, it was estimated that the tank was 100% full. The anhydrous ammonia in this tank is in its liquid state.

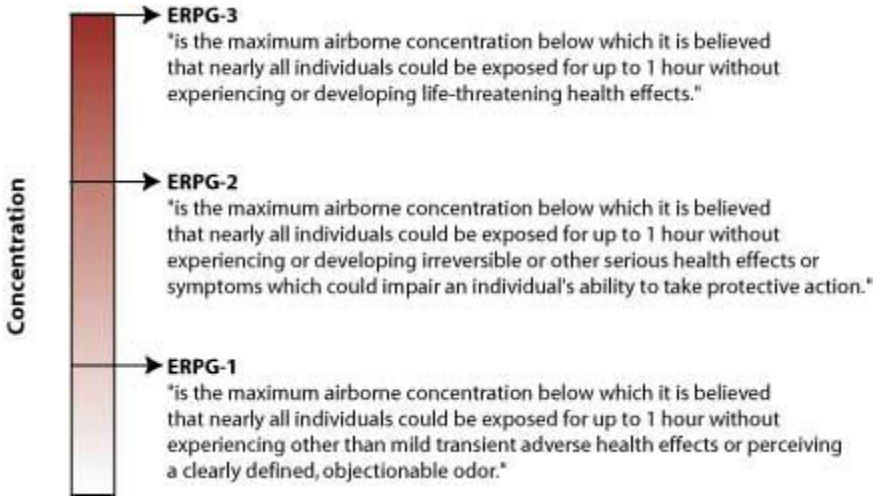
This release was based on a leak from a 2.5-inch-diameter hole, 12 inches above the bottom of the tank.

Figure 4-16: ALOHA Plume Modeling Parameters

```
SITE DATA:
  Location: RENSSELAER, INDIANA
  Building Air Exchanges Per Hour: 0.21 (sheltered single storied)
  Time: December 16, 2008  0814 hours EST (user specified)

CHEMICAL DATA:
  Chemical Name: AMMONIA                  Molecular Weight: 17.03 g/mol
  ERPG-1: 25 ppm     ERPG-2: 150 ppm      ERPG-3: 750 ppm
  IDLH: 300 ppm      LEL: 160000 ppm      UEL: 250000 ppm
  Ambient Boiling Point: -29.0° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 5 miles/hour from W at 10 meters
  Ground Roughness: open country          Cloud Cover: 5 tenths
  Air Temperature: 68° F                  Stability Class: F
  No Inversion Height                     Relative Humidity: 75%

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Flammable chemical escaping from tank (not burning)
  Tank Diameter: 10 feet                  Tank Length: 30 feet
  Tank Volume: 17,626 gallons
  Tank contains liquid                    Internal Temperature: 68° F
  Chemical Mass in Tank: 44.8 tons        Tank is 100% full
  Circular Opening Diameter: 2.5 inches
  Opening is 12 inches from tank bottom
  Release Duration: 32 minutes
  Max Average Sustained Release Rate: 7,760 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 86,613 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).
```

The Emergency Response Planning Guidelines (ERPGs) were developed by the ERPG committee of the American Industrial Hygiene Association. The ERPGs were developed as planning guidelines, to anticipate human adverse health effects caused by exposure to toxic chemicals. The ERPGs are three-tiered guidelines with one common denominator—a one-hour contact duration. Each guideline identifies the substance, its chemical and structural properties, animal toxicology data, human experience, existing exposure guidelines, the rationale behind the selected value, and a list of references. Figure 4-17 illustrates the ERPG three-tiered guidelines.

Figure 4-17: Three-Tiered ERPG Public Exposure Guidelines



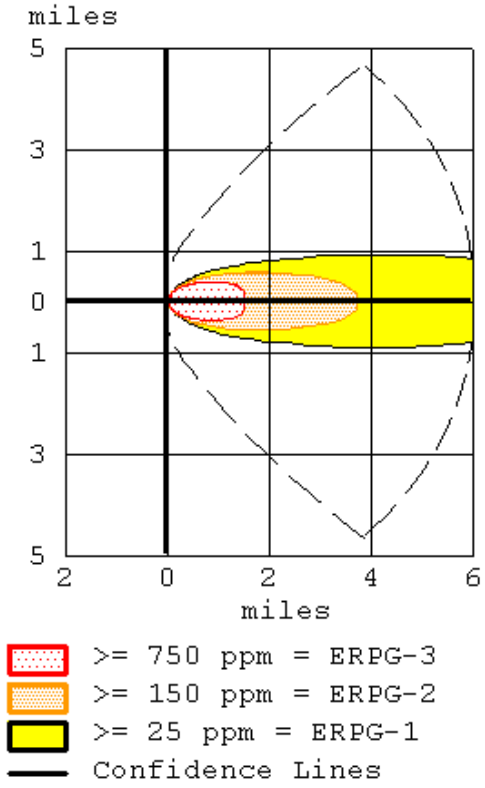
The definitions and format are from the ERPG publication.

The ERPG guidelines do not protect everyone. Hypersensitive individuals would suffer adverse reactions to concentrations far below those suggested in the guidelines. In addition, ERPGs, like other exposure guidelines, are based mostly on animal studies, thus raising the question of applicability to humans. The guidelines are focused on one period of time—one hour. Exposure in the field may be longer or shorter. However, the ERPG committee strongly advises against trying to extrapolate ERPG values to longer periods of time.

The most important point to remember about the ERPGs is that they do not contain safety factors usually incorporated into exposure guidelines such as the TLV. Rather, they estimate how the general public would react to chemical exposure. Just below the ERPG-1, for example, most people would detect the chemical and may experience temporary, mild effects. Just below the ERPG-3, on the other hand, it is estimated that the effects would be severe, although not life-threatening. The TLV differs in that it incorporates a safety factor into its guidelines, to prevent ill effects. The ERPG should serve as a planning tool, not a standard to protect the public.
Source: http://archive.orr.noaa.gov/cameo/locs/expguide.html

According to the ALOHA parameters, approximately 7,760 pounds of material would be released per minute. The images in Figure 4-18 and 4-19 depict the plume footprint generated by ALOHA.

Figure 4-18: Plume Footprint Generated by ALOHA

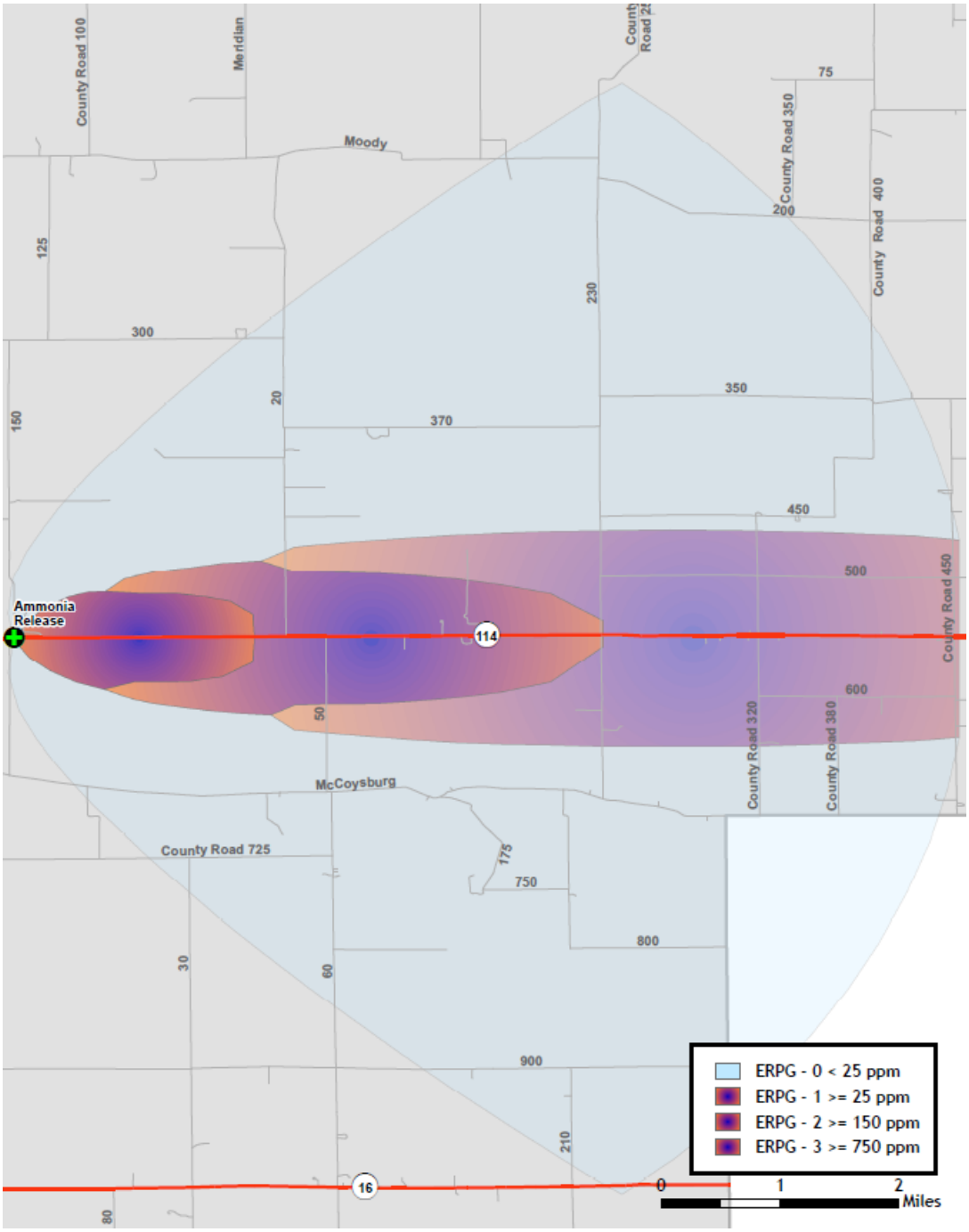


As the substance moves away from the source, the level of substance concentration decreases. Each color-coded area depicts a level of concentration measured in parts per million (ppm). For the purpose of clarification, this report will designate each level of concentration as a specific zone. The zones are as follows:

- **Zone 1** (ERPG-3): The red buffer (>=750 ppm) extends no more than 1.5 miles from the point of release after one hour.
- **Zone 2** (ERPG-2): The orange buffer (>=150 ppm) extends no more than 3.7 miles from the point of release after one hour.
- **Zone 3** (ERPG-1): The yellow buffer (>=25 ppm) extends more than six miles from the point of release after one hour.
- **Zone 4** (Confidence Lines): The dashed lines depict the level of confidence in which the exposure zones will be contained. The ALOHA model is 95% confident that the release will stay within this boundary.

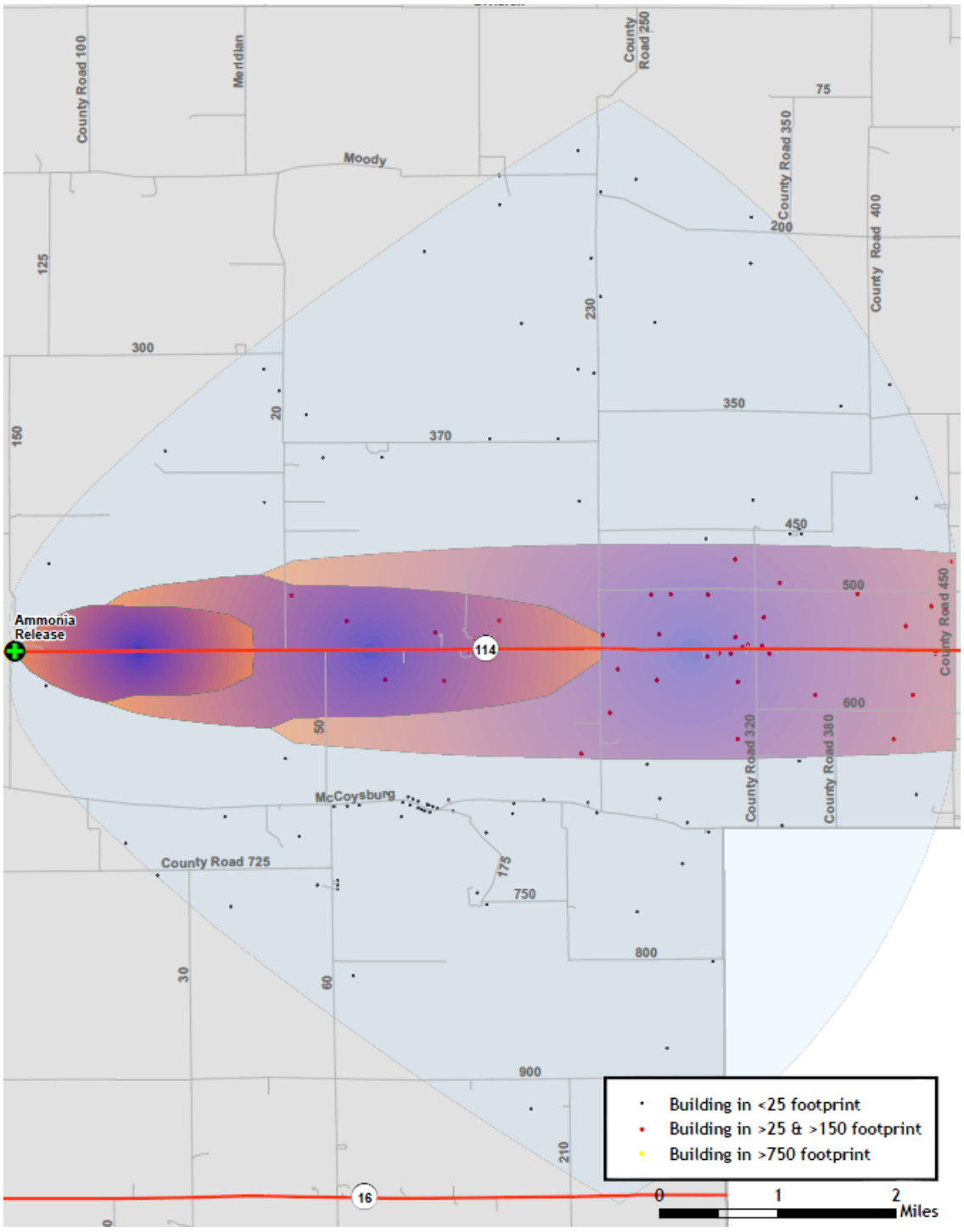
The image in Figure 4-19 depicts the plume footprint generated by ALOHA overlaid in ArcGIS.

Figure 4-19: ALOHA Plume Footprint Overlaid in ArcGIS



The Jasper County Building Inventory was added to ArcMap and overlaid with the plume footprint. The Building Inventory was then intersected with each of the four footprint areas to classify each point based upon the plume footprint in which it is located. Figure 4-20 depicts the Jasper County Building Inventory after the intersect process.

Figure 4-20: Jasper County Building Inventory Classified By Plume Footprint



Results

By summing the building inventory within all ERPG zones (Zone 1: 750 ppm, Zone 2: 150 ppm, Zone 3: 25 ppm, and Zone 4: <25 ppm), the GIS overlay analysis predicts that as many as 130 buildings could be exposed at a replacement cost of $20.1 million. If this event were to occur, approximately 140 people would be affected.

Building Inventory Damage

The results of the analysis against the Building Inventory points are depicted in Tables 4-36 through 4-40. Table 4-36 summarizes the results of the chemical spill by combining all ERPG zones.

Table 4-36: Estimated Exposure for all Zones (all ppm)

Occupancy	Population	Building Counts	Building Exposure (thousands)
Residential	140	56	$3,980
Commercial	0	1	$440
Industrial	0	2	$4,673
Agriculture	0	70	$11,075
Religious	0	0	$0
Government	0	1	$0
Education	0	0	$0
Total	**140**	**130**	**$20,168**

Tables 4-37 through 4-39 summarize the results of the chemical spill for each zone separately.

Table 4-37: Estimated Exposure for Zone 1 (750 ppm)

Occupancy	Population	Building Counts	Building Exposure (thousands)
Residential	3	1	$11
Commercial	0	0	$0
Industrial	0	2	$4,673
Agriculture	0	1	$143
Religious	0	0	$0
Government	0	0	$0
Education	0	0	$0
Total	**3**	**4**	**$4,827**

Table 4-38: Estimated Exposure for Zone 2 (150 ppm)

Occupancy	Population	Building Counts	Building Exposure (thousands)
Residential	10	4	$669
Commercial	0	0	$0
Industrial	0	0	$0
Agriculture	0	4	$651
Religious	0	0	$0
Government	0	0	$0
Education	0	0	$0
Total	**10**	**8**	**$1,320**

Table 4-39: Estimated Exposure for Zone 3 (25 ppm)

Occupancy	Population	Building Counts	Building Exposure (thousands)
Residential	33	13	$1,589
Commercial	0	1	$440
Industrial	0	0	$0
Agriculture	0	16	$1,774
Religious	0	0	$0
Government	0	1	$0
Education	0	0	$0
Total	**33**	**31**	**$3,803**

Zone 4 depicts the level of confidence in which the exposure zones will be contained. The ALOHA model is 95% confident that the release will stay within this boundary. Table 4-40 summarizes the results of the chemical spill for Zone 4.

Table 4-40: Estimated Exposure for Zone 4 (< 25 ppm)

Occupancy	Population	Building Counts	Building Exposure (thousands)
Residential	95	38	$1,711
Commercial	0	0	$0
Industrial	0	0	$0
Agriculture	0	49	$8,508
Religious	0	0	$0
Government	0	0	$0
Education	0	0	$0
Total	**95**	**87**	**$10,218**

Essential Facilities Damage

There are no essential facilities within the limits of the chemical spill plume.

Jasper County Hazardous Material Analysis #2

The U.S. EPA's ALOHA (Areal Locations of Hazardous Atmospheres) model was utilized to assess the area of impact for a chlorine release at the intersection of I-65 and State Road 114 east of Rensselaer, Indiana.

Chlorine is a greenish yellow gas with a pungent suffocating odor. The gas liquefies at -35°C and room pressure or will liquefy from pressure applied at room temperature. Contact with unconfined liquid chlorine can cause frostbite from evaporative cooling. Chlorine does not burn, but, like oxygen, supports combustion. The toxic gas can have adverse health effects from either long-term inhalation of low concentrations of vapors or short-term inhalation of high concentrations. Chlorine vapors are much heavier than air and tend to settle in low areas. Chlorine is commonly used to purify water, bleach wood pulp, and make other chemicals.

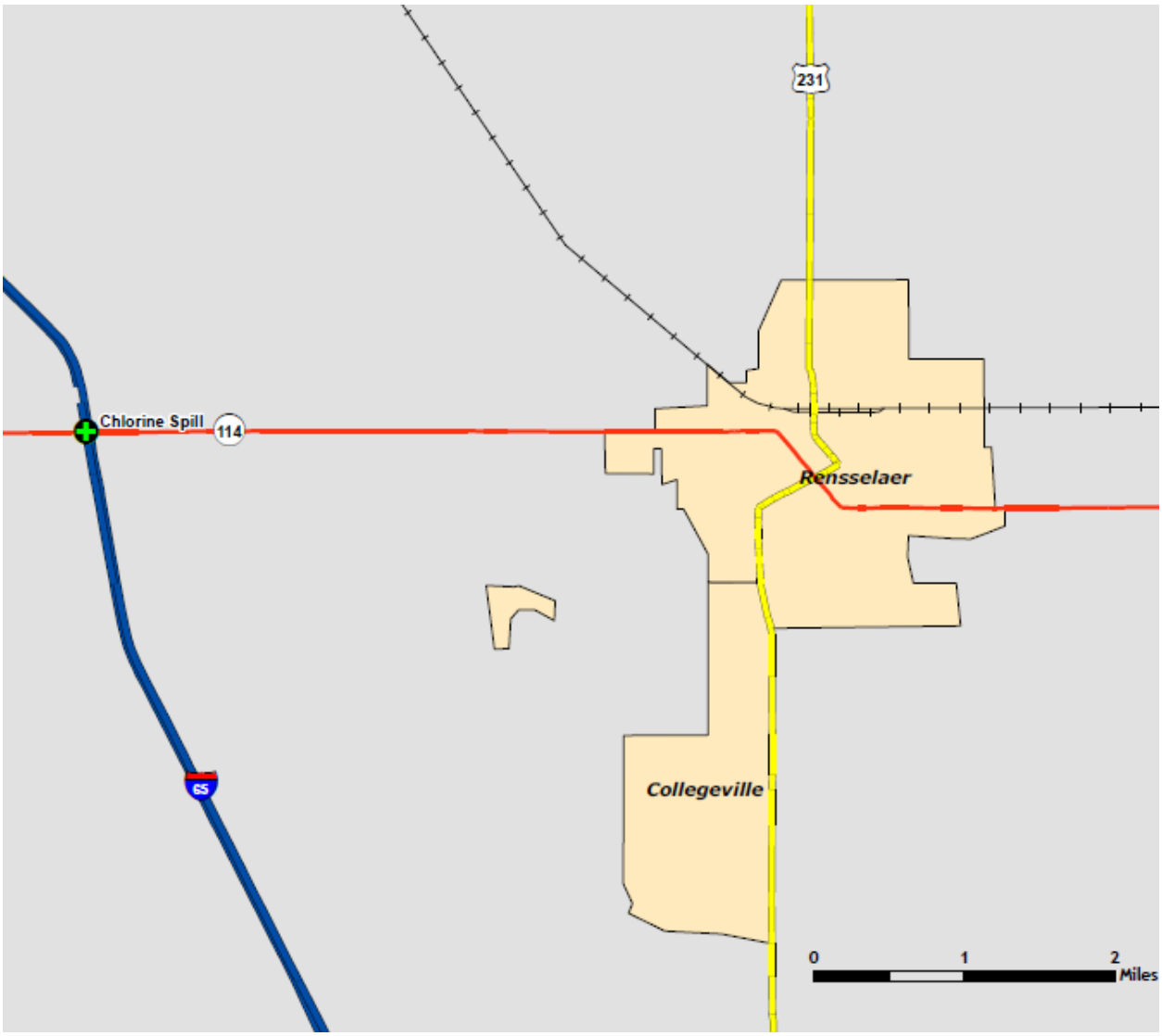
Source: CAMEO

ALOHA is a computer program designed especially for use by people responding to chemical accidents, as well as for emergency planning and training. Chlorine is a common chemical used in industrial operations and can be found in either liquid or gas form. Rail and truck tankers commonly haul chlorine to and from facilities.

For this scenario, we assumed moderate atmospheric and climatic conditions with a slight breeze from the west.

The geographic area covered in this analysis is depicted in Figure 4-21.

Figure 4-21: Location of Chemical Release



Analysis

The ALOHA atmospheric modeling parameters, depicted in Figure 4-22, were based upon a westerly wind speed of five miles per hour. The temperature was 68°F with 75% humidity and partly cloudy skies.

The source of the chemical spill is a horizontal, cylindrical-shaped tank. The diameter of the tank was set to eight feet and the length set to 33 feet (12,408 gallons). At the time of its release, it was estimated that the tank was 100% full. The Chlorine in this tank is in its liquid state.

This release was based on a leak from a 2.5-inch-diameter hole, 12 inches above the bottom of the tank.

Figure 4-22: ALOHA Plume Modeling Parameters

```
SITE DATA:
  Location: RENSSELAER3, INDIANA
  Building Air Exchanges Per Hour: 0.34 (sheltered single storied)
  Time: October 5, 2008  1652 hours CDT (using computer's clock)

CHEMICAL DATA:
  Chemical Name: CHLORINE                 Molecular Weight: 70.91 g/mol
  AEGL-1(60 min): 0.5 ppm   AEGL-2(60 min): 2 ppm   AEGL-3(60 min): 20 ppm
  IDLH: 10 ppm
  Carcinogenic risk - see CAMEO
  Ambient Boiling Point: -30.2° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 5 knots from W at 10 meters
  Ground Roughness: open country          Cloud Cover: 5 tenths
  Air Temperature: 68° F                  Stability Class: C
  No Inversion Height                     Relative Humidity: 75%

SOURCE STRENGTH:
  Leak from hole in horizontal cylindrical tank
  Non-flammable chemical is escaping from tank
  Tank Diameter: 8 feet                   Tank Length: 33 feet
  Tank Volume: 12,408 gallons
  Tank contains liquid                    Internal Temperature: 68° F
  Chemical Mass in Tank: 73.0 tons        Tank is 100% full
  Circular Opening Diameter: 2.5 inches
  Opening is 12.0 inches from tank bottom
  Release Duration: 23 minutes
  Max Average Sustained Release Rate: 10,400 pounds/min
     (averaged over a minute or more)
  Total Amount Released: 138,213 pounds
  Note: The chemical escaped as a mixture of gas and aerosol (two phase flow).

THREAT ZONE:
  Model Run: Heavy Gas
  Red   : 4.8 miles --- (20 ppm = AEGL-3(60 min))
  Orange: greater than 6 miles --- (2 ppm = AEGL-2(60 min))
  Yellow: greater than 6 miles --- (0.5 ppm = AEGL-1(60 min))
```

Acute Exposure Guideline Levels (AEGLs) are intended to describe the health effects on humans due to once-in-a-lifetime or rare exposure to airborne chemicals. The National Advisory Committee for AEGLs is developing these guidelines to help both national and local authorities, as well as private companies, deal with emergencies involving spills or other catastrophic exposures.

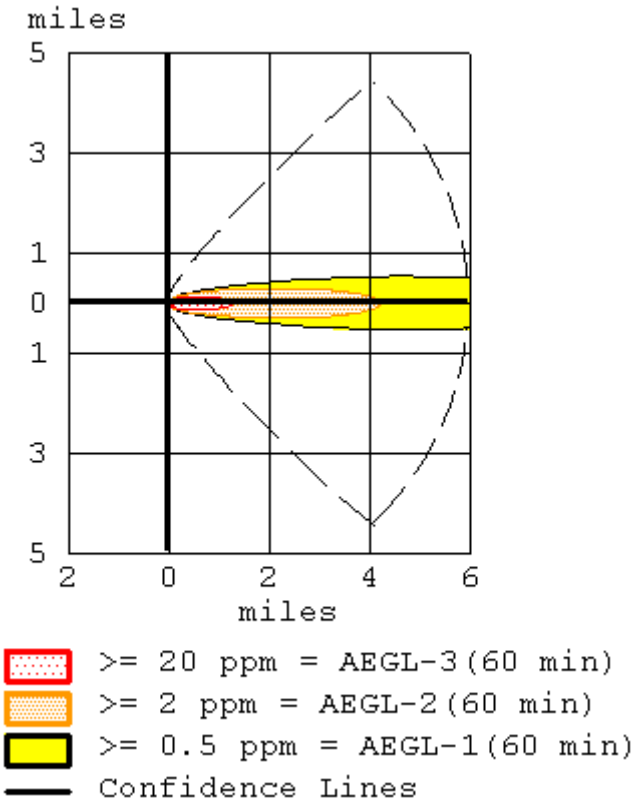
- AEGL 1: Above this airborne concentration of a substance, it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

- AEGL 2: Above this airborne concentration of a substance, it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

- AEGL 3: Above this airborne concentration of a substance, it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

According to the ALOHA parameters, approximately 10,400 pounds of material would be released per minute. The image in Figure 4-23 depicts the plume footprint generated by ALOHA.

Figure 4-23: Plume Footprint Generated by ALOHA

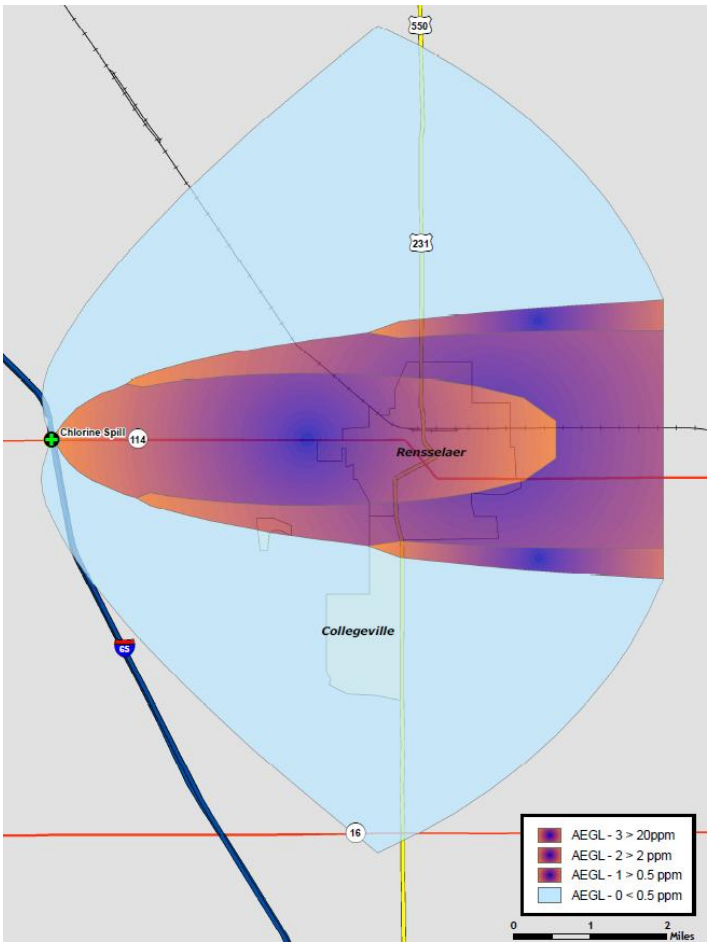


As the substance moves away from the source, the level of substance concentration decreases. Each color-coded area depicts a level of concentration measured in parts per million (ppm). For the purpose of clarification, this report will designate each level of concentration as a specific zone. The zones are as follows:

- **Zone 1** (AEGL-3): The red buffer (>=20 ppm) extends no more than 4.8 miles from the point of release after one hour.
- **Zone 2** (AEGL-2): The orange buffer (>=2 ppm) extends no more than six miles from the point of release after one hour.
- **Zone 3** (AEGL-1): The yellow buffer (>=0.5 ppm) extends more than six miles from the point of release after one hour.
- **Zone 4** (Confidence Lines): The dashed lines depict the level of confidence in which the exposure zones will be contained. The ALOHA model is 95% confident that the release will stay within this boundary.

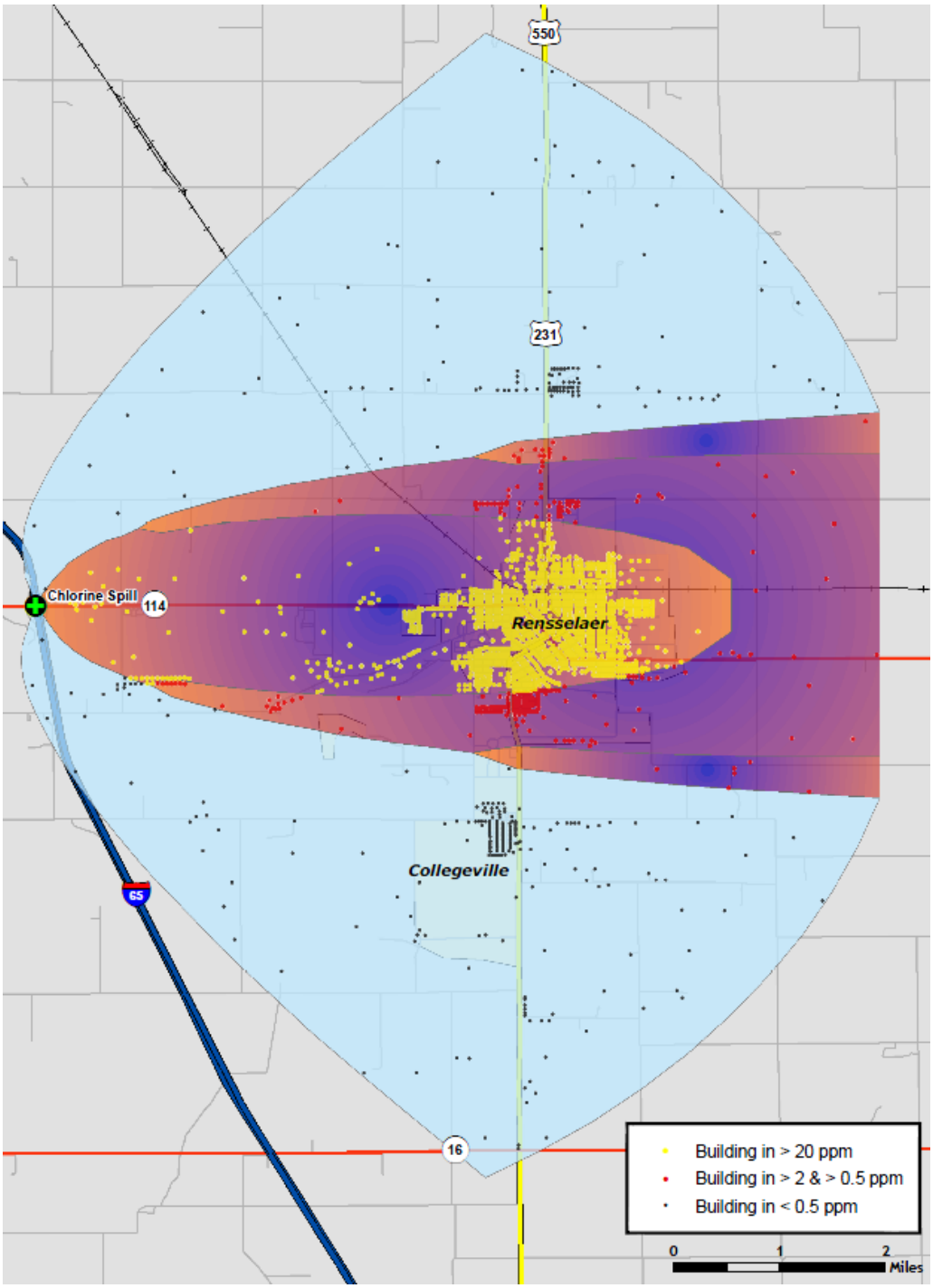
The image in Figure 4-24 depicts the plume footprint generated by ALOHA.

Figure 4-24: ALOHA Plume Footprint Overlaid in ArcGIS



The Jasper Building Inventory was added to ArcMap and overlaid with the plume footprint. The Building Inventory was then intersected with each of the four footprint areas to classify each point based upon the plume footprint in which it is located. Figure 4-25 depicts the Jasper Building Inventory after the intersect process.

Figure 4-25: Jasper County Building Inventory Classified By Plume Footprint



Results

By summing the building inventory within all AEGL zones (Zone 1: 20 ppm, Zone 2: 2 ppm, Zone 3: 0.5 ppm, and Zone 4: <0.5 ppm), the GIS overlay analysis predicts that as many as 2,539 buildings could be exposed at a replacement cost of $394 million. If this event were to occur, approximately 5,150 people would be affected.

Building Inventory Damage

The results of the analysis against the Building Inventory points are depicted in Tables 4-41 through 4-45. Table 4-41 summarizes the results of the chemical spill by combining all AEGL zones.

Table 4-41: Estimated Exposure for all Zones (all ppm)

Occupancy	Population	Building Counts	Building Exposure (thousands)
Residential	5,150	2,060	$217,597
Commercial	0	210	$122,916
Industrial	0	62	$39,643
Agriculture	0	106	$14,830
Religious	0	5	$0
Government	0	90	$0
Education	0	6	$0
Total	**5,150**	**2,539**	**$394,985**

Tables 4-42 through 4-44 summarize the results of the chemical spill for each zone separately.

Table 4-42: Estimated Exposure for Zone 1 (20 ppm)

Occupancy	Population	Building Counts	Building Exposure (thousands)
Residential	4,043	1,617	$156,512
Commercial	0	164	$44,575
Industrial	0	51	$33,282
Agriculture	0	14	$1,469
Religious	0	2	$0
Government	0	77	$0
Education	0	5	$0
Total	**4,043**	**1,930**	**$ 235,838**

Table 4-43: Estimated Exposure for Zone 2 (2 ppm)

Occupancy	Population	Building Counts	Building Exposure (thousands)
Residential	503	201	$27,261
Commercial	0	30	$33,915
Industrial	0	10	$6,235
Agriculture	0	8	$1,470
Religious	0	0	$0
Government	0	6	$0
Education	0	1	$0
Total	**503**	**256**	**$68,881**

Table 4-44: Estimated Exposure for Zone 3 (0.5 ppm)

Occupancy	Population	Building Counts	Building Exposure (thousands)
Residential	30	12	$1,638
Commercial	0	7	$1,869
Industrial	0	0	$0
Agriculture	0	3	$293
Religious	0	0	$0
Government	0	0	$0
Education	0	0	$0
Total	**30**	**22**	**$3,801**

Zone 4 depicts the level of confidence in which the exposure zones will be contained. The ALOHA model is 95% confident that the release will stay within this boundary. Table 4-45 summarizes the results of the chemical spill for Zone 4.

Table 4-45: Estimated Exposure for Zone 4 (<.05 ppm)

Occupancy	Population	Building Counts	Building Exposure (thousands)
Residential	575	230	$32,186
Commercial	0	9	$42,557
Industrial	0	1	$126
Agriculture	0	81	$11,597
Religious	0	3	$0
Government	0	7	$0
Education	0	0	$0
Total	**575**	**331**	**$86,466**

Essential Facilities Damage

There are 13 essential facilities within the limits of the chemical spill plume. The affected facilities are identified in Table 4-46. Their geographic locations are depicted in Figures 4-26.

Table 4-46: Essential Facilities within Plume Footprint

Name
Jasper County Hospital
Rensselaer Care Center
Alternacare Nursing Home
Jasper County Civil Defense
Rensselaer Fire Dept
Rensselaer Police Dept
Jasper County Sheriff Dept
Rensselaer Central High School
Van Rensselaer Elementary School
Monnett Elementary School
Saint Augustine School

Figure 4-26: Essential Facilities within Plume Footprint

Vulnerability to Future Assets/Infrastructure for Hazardous Materials Storage and Transport Hazard

Any new development within the county will be vulnerable to these events, especially development along major roadways.

Analysis of Community Development Trends

Because the hazardous material hazard events may occur anywhere within the county, future development will be impacted. The major transportation routes and the industries located in Jasper County pose a threat of dangerous chemicals and hazardous materials release.

4.4.8 Fire Hazard

Hazard Definition for Fire Hazard

The Jasper County Comprehensive Hazard Analysis has identified four major categories of fires within the county.

Tire Fires

The State of Indiana generates thousands of scrap tires annually. Many of those scrap tires end up in approved storage sites that are carefully regulated and controlled by federal and state officials. However, scrap tires are sometimes intentionally dumped in unapproved locations throughout the state. Jasper County has no approved location for tire disposal and storage, but the number of unapproved locations cannot be readily determined. These illegal sites are owned by private residents who have been continually dumping waste and refuse, including scrap tires, at those locations for many years.

Tire disposal sites can be fire hazards, in large part, because of the enormous number of scrap tires typically present at one site. This large amount of fuel renders standard firefighting practices nearly useless. Flowing and burning oil released by the scrap tires can spread the fire to adjacent areas. Tire fires differ from conventional fires in the following ways:

- Relatively small tire fires can require significant fire resources to control and extinguish.
- Those resources often cost much more than Jasper County government can absorb compared to standard fire responses.
- There may be significant environmental consequences of a major tire fire. Extreme heat can convert a standard vehicle tire into approximately two gallons of oily residue that may leak into the soil or migrate to streams and waterways.

Structural Fires

Lightning strikes, poor building construction, and building condition are the main causes for most structural fires in Indiana. Jasper County has a few structural fires each year countywide.

Wildfires

Heavily wooded or forested areas cover only a small portion of Jasper County's total land base, but a significant portion of the county is farmland. When conditions are right, forests and farmland may become vulnerable to devastating wildfires.

Arson

It is important to note that arson is a contributing factor to fire-related incidents within the county.

Previous Occurrences for Fire Hazard

Jasper County has been fortunate that there have not been any tire fires in the County in recent history.

There have not been many structural fires with a significant number of deaths or injuries. Table 4-47 lists major structural fires identified in the Jasper County CEMP that have taken place from 1990 to 2003.

Table 4-47: Significant Structural Fires in Jasper County

Date	Location	Characteristics of the Event
1996	Rensselaer	A fire started at the baseball cards store and spread to Fagen's Drug Store. Both businesses were destroyed in the blaze. Five fire departments responded to the incident.
1994	Rensselaer	An electrical fire occurred at Darryl's Pastry Shop in the downtown area. People were working in the kitchen when a loud pop was heard and a fire began. The workers tried to put out the fire, but were unsuccessful. The building was a total loss.
1993	Rensselaer	Three businesses in the downtown area were destroyed by fire leaving several thousand dollars in damage. No injuries or deaths were reported in the late night blaze. Four fire departments responded to the incident.

Jasper County has experienced only one major wildfire in recent history. The fire occurred in 2002 in a rural part of the County and burned 350 acres. Heavy smoke made visibility on the nearby highway difficult.

No occurrences of arson have been reported according to the Jasper County CEMP.

Geographic Location for Fire Hazard

Fire hazards occur countywide and therefore affect the entire county. The heavily forested areas in the county have a higher chance of widespread fire hazard.

Hazard Extent for Fire Hazard

The extent of the fire hazard varies both in terms of the severity of the fire and the type of material being ignited. All communities in Jasper County are affected by fire equally.

Calculated Priority Risk Index for Fire Hazard

Although there is the possibility of a major fire, based on historical information the probability of such an event is unlikely. According to the CPRI, hazardous fires are ranked as the number seven hazard in the county.

CPRI = Probability X .45 + Magnitude/Severity X .30 + Warning Time X .15 + Duration of event X .10.

Probability	+	Magnitude /Severity	+	Warning Time	+	Duration	=	CPRI
2 x .45	+	**1** x .30	+	**4** x .15	+	**1** x .10	=	**1.9**

Vulnerability Analysis for Fire Hazard

This hazard impacts the entire jurisdiction equally; therefore, the entire population and all buildings within the county are vulnerable to fires and can expect the same impacts within the affected area.

Table 4-8 lists the types and numbers of all essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

A table of the building exposure in terms of types and numbers of buildings for the entire county is provided in Table 4-9. Because of the difficulty predicting which communities are at risk, the entire population and all buildings have been identified at risk.

Critical Facilities

All critical facilities are vulnerable to a fire hazards. A critical facility will encounter many of the same impacts as any other building within the jurisdiction. These impacts include structural damage from fire and water damage from efforts extinguishing fire. Table 4-8 lists the types and numbers of essential facilities in the area. Critical facility information, including replacement costs, is included in Appendix F. A map of the critical facilities is included in Appendix G.

Building Inventory

A table of the building exposure in terms of types and numbers of buildings for the entire county is provided in Table 4-9. Impacts to the general buildings within the county are similar to the damages expected to the critical facilities. These impacts include structural damage from fire and water damage from efforts to extinguish the fire.

Infrastructure

During a fire the types of infrastructure that could be impacted include roadways, utility lines/pipes, railroads, and bridges. Since the county's entire infrastructure is equally vulnerable, it is important to emphasize that any number of these items could become damaged during a fire. Potential impacts include structural damage resulting in impassable roadways and power outages.

Vulnerability to Future Assets/Infrastructure for Fire Hazard

Any future development will be vulnerable to these events.

Analysis of Community Development Trends

Fire hazard events may occur anywhere within the county, because of this future development will be impacted.

Section 5 – Mitigation Strategy

The goal of mitigation is to reduce the future impacts of a hazard including property damage, disruption to local and regional economies, and the amount of public and private funds spent to assist with recovery. The goal of mitigation is to build disaster-resistant communities. Mitigation actions and projects should be based on a well constructed risk assessment, which is provided in Section 4 of this plan. Mitigation should be an ongoing process adapting over time to accommodate a community's needs.

5.1 Community Capability Assessment

The capability assessment identifies current activities used to mitigate hazards. The capability assessment identifies the policies, regulations, procedures, programs, and projects that contribute to the lessening of disaster damages. The assessment also provides an evaluation of these capabilities to determine whether the activities can be improved in order to more effectively reduce the impact of future hazards. The following sections identify existing plans and mitigation capabilities within all of the communities listed in Chapter 2 of this plan.

5.1.1 National Flood Insurance Program (NFIP)

The county and all of the communities within the county are members of the National Flood Insurance Program (NFIP). HAZUS-MH identifies approximately 440 households were located in the Jasper County Special Flood Hazard Area; 93 households paid flood insurance, insuring $9,061,600 in property value. The total premiums collected amounted to $52,011, which on average was $559 annually. As of November 30, 2006, 29 claims were filed totaling $199,408. The average claim was $6,876.

The county and incorporated areas do not participate in the National Flood Insurance Program's (NFIP) Community Rating System (CRS). The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: 1) reduce flood losses; 2) facilitate accurate insurance rating; and 3) promote the awareness of flood insurance. Table 5-1 identifies each community and the date each participant joined the NFIP.

Table 5-1: Additional Information on Communities Participating in the NFIP

Community	Participation Date	FIRM Date	CRS Date	CRS Rating	Flood Plain Zoning Ordinance Adopted Last
Town of Demotte	02/15/74	N/A	N/A	N/A	09/01/76
Jasper County	05/12/78	07/01/94	N/A	N/A	07/01/94
Town of Remington	05/31/74	11/01/95	N/A	N/A	11/01/95
City of Rensselaer	02/01/74	02/01/94	N/A	N/A	02/01/94

5.1.2 Storm Water Management Stream Maintenance Program/Ordinance

In the Jasper County Zoning Code (updated April 23, 2008) in Section 150-1.06 (General Performance Standards), it is stated that no use of the land shall produce erosion or other pollutants in such quantity as to be detrimental to adjacent properties or conflict with applicable State, Federal, or local water quality standards.

The Town of Wheatfield addresses stormwater drainage in its Comprehensive Plan (August 2008), indicating that stormwater drainage systems are typically constructed and maintained by property tax dollars, whereas water and sewer systems have their own funding sources.

The 1996 study, Drainage Study of Carpenter Creek, Jasper County Indiana, Preliminary Investigation of Alternatives, addressed flooding in southern Jasper County and recommended bridges on routes 231 and 24 be raised and enlarged to decrease the potential of flooding, a detention pond (levee) south of town be constructed, and channel clearing and changes in elevations be made in flood-prone areas. Unfortunately, no action has been taken to mitigate flood damage in this area.

5.1.3 Zoning Management Ordinance

Jasper County's Zoning Code, Article V, Section 150-5.01, indicates that any new construction must first address the area of stormwater runoff. The Jasper County Zoning Code in Section 150-5.02 indicates that the right-of-way of ditches and streams is defined as 75 feet on either side of the centerline of the respective tributary. Furthermore, no permanent structures are to be placed in that right-of-way without written consent of the Jasper County Drainage Board.

Article VI of the Jasper County Zoning Code, Section 150-6.02, indicates that the duties of the Director of Planning and Development include verification that construction in a flood plain has been approved by the Indiana Natural Resources Commission and that construction will incorporate flood-proofing techniques. The Director of Planning and Development is also charged with reviewing construction proposals and requiring appropriate changes and modifications in order to assure the following:

(a) It is consistent with the need to minimize flood damages;

(b) All public utilities and facilities, such as sewer, gas, electrical, and water systems, are located and constructed to minimize or eliminate flood damage;

(c) Adequate drainage is provided so as to reduce exposure to flood hazards;

(d) Onsite waste disposal systems, if provided, will be located and designed to avoid impairment of them or contamination from them during the occurrence of the regulatory flood.

In Article II, Jasper County has a zoning category, Land Application District, which overlaps other zoning districts. The Flood Plain District is intended to protect and encourage agriculture uses to protect the water and soil resources of the county and to prevent soil and water pollution

by controlling land application operations in the county. Table 5-2 lists Jasper County's zoning plans and ordinances.

Table 5-2: Description of Zoning Plans/Ordinances

Community	Comp Plan	Zoning Ord	Subd Control Ord	Erosion Control	Storm Water Mgmt	Burning Ord.	Seismic Ord.	Bldg. Stndrds.
Jasper County	1982; Amended 2002; Updated 2008				Amended 2008			
Town of Wheatfield	2008	1980; Updated 2000	1980; Updated 2000		2008			
Town of Remington	1994	1994		1994	1994			1994

5.1.4 Erosion Management Program/ Policy

The Jasper County Zoning Code, Article V, Soils, Drainage and Erosion, addresses proposed construction as it impacts stormwater runoff. Areas around streams and ditches are protected and controlled to minimize runoff resulting from man-made changes and natural events.

5.1.5 Fire Insurance Rating Programs/ Policy

There are four volunteer fire departments in Jasper County. No community has a paid fire department. These departments are listed in Table 5-3. The insurance ratings for Remington and Rensselaer fire departments in the city limits and throughout the rest of the township are listed in Table 5-3.

Table 5-3: Listing of Fire Departments, Ratings, and Number of Firefighters

Fire Department	Fire Insurance Rating	Number of Firefighters
Remington-Carpenter Volunteer Fire Department	ISO Class 6 in Town; ISO Class 9 in Township	16
Rensselaer-Marion Volunteer Fire Department	City – ISO 6; Outside City with Hydrants 9; All Others 10	25
Wheatfield Volunteer Fire Department		
Keener Township Volunteer Fire Department		

5.1.6 Land Use Plan

Article II of the Zoning Code for Jasper County addresses land uses and stresses that, outside of flood or pond areas, the land should be in moderately well-drained or excessively drained.

Sections 150-2.11 and 2.12 address industrial districts and the placement of hazardous materials, both for use and storage, with regard to residential dwellings. Section 150-2.14, Flood Plain District, lists the criteria to be in place for structures. The criteria include approval of the Indiana Department of Natural Resources and compliance with construction techniques to minimize flood damage. Manufactured homes must be placed above the Flood Protection Grade and

securely affixed to an adequately anchored foundation. In addition, manufactured homes must be placed on reinforced piers or other foundation elements that are no less than 36 inches in height above the Flood Protection Grade. However, buildings below this grade can be "flood-proofed" by being water tight and resistant to the impact of the regulatory flood.

The Wheatfield Zoning Code and Subdivision Control Code (Adopted 1980, updated in 2000) addresses land use within the Wheatfield jurisdiction. This code addresses agricultural, residential, and business and follows the Jasper County Zoning Code with regard to hazard mitigation.

5.1.7 Building Codes

Table 5-2 identifies the Building Standards adopted within the county. There are no building codes specific to seismic control. Many of the building codes for manufactured homes require tie downs to minimize wind effects (see Section 5.1.6).

The Remington Building Code states that the purpose of the code is to provide minimum standards for the protection of life, limb, health, environment, public safety and welfare, and for the conservation of energy in the design and construction of buildings and structures. This philosophy will promote designs which minimize damage from a variety of hazards that might befall the county.

5.2 Mitigation goals

The Jasper County Pre-disaster Mitigation Plan committee met to consider the goals and objectives for mitigation strategies after the hazards in the county were defined and risk analyses performed. Priority was given to those hazards ranking highest in the community along with mitigation strategies that would lessen the impact of the hazard. Each jurisdiction was considered and strategies defined that would impact a significant number of citizens and area businesses. The mitigation goals were developed to be in concert with goals that have already been defined in the four jurisdictions of the county.

Goal 1: Lessen the impacts of hazards to new and existing infrastructure

(a) Objective: Retrofit critical facilities with structural design practices and equipment that will withstand natural disasters and offer weather-proofing.

(b) Objective: Equip public facilities and communities to guard against damage caused by secondary effects of hazards.

(c) Objective: Minimize the amount of infrastructure exposed to hazards.

(d) Objective: Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county.

(e) Objective: Improve emergency sheltering in Jasper County.

Goal 2: Create new or revise existing plans/maps related to hazards affecting Jasper County

(a) Objective: Support compliance with the NFIP for each jurisdiction in Jasper County.

(b) Objective: Review and update existing community studies, plans, and ordinances to support hazard mitigation.

(c) Objective: Conduct new studies/research to profile hazards and follow up with mitigation strategies.

Goal 3: Develop long-term strategies to educate the public on the hazards affecting Jasper County

(a) Objective: Raise public awareness on hazard mitigation.

(b) Objective: Improve education of emergency personnel and public officials.

5.3 Mitigation Actions/Projects

Upon completion of the risk assessment and development of the goals and objectives, the Planning Committee was provided with a list of the six mitigation measure categories from the *FEMA State and Local Mitigation Planning How to Guides*. The measures are listed as follows:

- **Prevention:** Government, administrative, or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and storm water management regulations.

- **Property Protection:** Actions that involve the modification of existing buildings or structures to protect them from a hazard or removal from the hazard area. Examples include: acquisition, elevation, structural retrofits, storm shutters, and shatter resistant glass.

- **Public Education and Awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

- **Natural Resource Protection:** Actions that, in addition to minimizing hazard losses, preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.

- **Emergency Services:** Actions that protect people and property during and immediately after a disaster or hazard event. Services include warning systems, emergency response services, and protection of critical facilities.

- **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, levees, floodwalls, seawalls, retaining walls, and safe rooms.

After Meeting #3, held October 9, 2008, MHMP members were presented with the task of individually listing potential mitigation activities using the FEMA evaluation criteria. The MHMP members brought their mitigation ideas to Meeting #4 which was held on November 20, 2008. The evaluation criteria (STAPLE+E) involved the following categories and questions.

Social:
- Will the proposed action adversely affect one segment of the population?
- Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?

Technical:
- How effective is the action in avoiding or reducing future losses?
- Will it create more problems than it solves?
- Does it solve the problem or only a symptom?
- Does the mitigation strategy address continued compliance with the NFIP?

Administrative:
- Does the jurisdiction have the capability (staff, technical experts, and/or funding) to implement the action, or can it be readily obtained?
- Can the community provide the necessary maintenance?
- Can it be accomplished in a timely manner?

Political:
- Is there political support to implement and maintain this action?
- Is there a local champion willing to help see the action to completion?
- Is there enough public support to ensure the success of the action?
- How can the mitigation objectives be accomplished at the lowest cost to the public?

Legal:
- Does the community have the authority to implement the proposed action?
- Are the proper laws, ordinances, and resolution in place to implement the action?
- Are there any potential legal consequences?
- Is there any potential community liability?
- Is the action likely to be challenged by those who may be negatively affected?
- Does the mitigation strategy address continued compliance with the NFIP?

Economic:

- Are there currently sources of funds that can be used to implement the action?
- What benefits will the action provide?
- Does the cost seem reasonable for the size of the problem and likely benefits?
- What burden will be placed on the tax base or local economy to implement this action?
- Does the action contribute to other community economic goals such as capital improvements or economic development?
- What proposed actions should be considered but be "tabled" for implementation until outside sources of funding are available?

Environmental:

- How will this action affect the environment (land, water, endangered species)?
- Will this action comply with local, state, and federal environmental laws and regulations?
- Is the action consistent with community environmental goals?

The development of the MHMP is the first step in a multi-step process to implement projects and policies to mitigate hazards in the county and the communities in the county. Table 5-4 presents the mitigation actions and projects.

5.3.1 Completed or Current Mitigation Actions/Projects

Since this is the first mitigation plan developed for Jasper County, there are no deleted or deferred mitigation items. Table 5-4 refers to completed or ongoing mitigation actions.

Table 5-4: Completed and Ongoing Mitigation Actions

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Comments
Distribute weather radios throughout the county	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county	Tornado, Thunderstorm	Jasper County, Demotte, Remington, Rensselaer, Wheatfield	The County EMA has implemented this strategy. Local resources have been used to target and inform the resident population.
Complete a weekly all-hazard radio check for 800-mHz first responder radios and NOAA radios	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county	Tornado, Thunderstorm	Jasper County, Demotte, Remington, Rensselaer, Wheatfield	The County EMA has implemented various aspects of this strategy. Local resources will continue to be used to fund this. The all-hazard radio-check is an ongoing action and subject to the acquisition of funds and resources.

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Comments
Implement the requirement of tie-downs for all manufactured housing	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Minimize the amount of infrastructure exposed to hazards	Tornado, Thunderstorms	Jasper County, Demotte, Remington, Rensselaer, Wheatfield	The County EMA has implemented various aspects of this strategy. Local resources will continue to be used to fund this. The implementation of tie-downs is an ongoing action and subject to the acquisition of funds and resources.
Buy out 8 homes on Austin Street that are located in a flood-prone area	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Minimize the amount of infrastructure exposed to hazards	Flood	Rensselaer	The jurisdiction of Rensselaer and the County EMA completed this strategy in 2003.
Buy out 2 homes in flood-prone area: SE corner of Begonia and 12th Streets	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Minimize the amount of infrastructure exposed to hazards	Flood	Demotte	The jurisdiction of Demotte has made several improvements to this area, but the two identified homes consistently flood during heavy rains. Funding has not yet been secured for the purchase of the homes; however, the residents may relocate. Implementation of this project, if funding is secured, is projected to be complete within three years.
Modify the storm sewer system north of the railroad tracks to the School House Ditch	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Equip public facilities and communities to guard against damage caused by secondary effects of hazards	Flood	Rensselaer	The jurisdiction of Rensselaer, with funding through INDOT, essentially completed Phase I of this project in 2008; completion of storm sewer updates is anticipated by the end of 2010.
Installation and up-grade of sirens in the jurisdiction of Remington	**Goal**: Decrease the potential human impact of predictable hazards such as tornadoes, floods and winter storms **Objective:** Provide residents of Remington with adequate warning of imminent danger from hazards such as tornadoes, floods and winter storms	Tornado, floods and winter storms	Remington	The jurisdiction of Remington completed the installation of new sirens and the up-grading of old sirens in the town of Remington in 2007.

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Comments
Provide safe housing for victims of disasters	**Goal**: Lessen the impacts of hazards to new and existing infrastructure **Objective:** Improve emergency sheltering in Jasper County	Tornado, floods, winter storms, HAZMAT	Wheatfield	The community of Wheatfield has identified the "safe site" as the 1st Baptist Church in Wheatfield. Funding from the congregation and community has been received to purchase a generator and to provide food supplies and storage of supplies. The community as established agreements with local businesses to provide additional assistance in the event of an emergency.

5.4 Implementation Strategy and Analysis of Mitigation Projects

Implementation of the mitigation plan is critical to the overall success of the mitigation planning process. The initial step is to decide, based upon many factors, which action will be undertaken first. In order to pursue the top priority, an analysis and prioritization of the actions is important. Some actions may occur before the top priority due to financial, engineering, environmental, permission, and site control issues. Public awareness and input of these mitigation actions can increase knowledge to capitalize on funding opportunities and monitoring the progress of an action.

In Meeting #4, the planning team prioritized mitigation actions based on a number of factors. A rating of High, Medium, or Low was assessed for each mitigation item and is listed next to each item in Table 5-6. The factors were the STAPLE+E (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) criteria listed in Table 5-5.

Table 5-5: STAPLE+E planning factors

S – Social	Mitigation actions are acceptable to the community if they do not adversely affect a particular segment of the population, do not cause relocation of lower income people, and if they are compatible with the community's social and cultural values.
T – Technical	Mitigation actions are technically most effective if they provide a long-term reduction of losses and have minimal secondary adverse impacts.
A – Administrative	Mitigation actions are easier to implement if the jurisdiction has the necessary staffing and funding.
P – Political	Mitigation actions can truly be successful if all stakeholders have been offered an opportunity to participate in the planning process and if there is public support for the action.
L – Legal	It is critical that the jurisdiction or implementing agency have the legal authority to implement and enforce a mitigation action.
E – Economic	Budget constraints can significantly deter the implementation of mitigation actions. Hence, it is important to evaluate whether an action is cost-effective, as determined by a cost benefit review, and possible to fund.
E – Environmental	Sustainable mitigation actions that do not have an adverse effect on the environment, comply with federal, state, and local environmental regulations, and are consistent with the community's environmental goals, have mitigation benefits while being environmentally sound.

For each mitigation action related to infrastructure, new and existing infrastructure was considered. Additionally, the mitigation strategies address continued compliance with the NFIP. While an official cost benefit review was not conducted for any of the mitigation actions, the estimated costs were discussed. The overall benefits were considered when prioritizing mitigation items from High to Low. Projects with a High priority rating are to be completed within two years, those with Medium priority ratings are to be completed in two to four years, and those with Low ratings are to be completed within four to six years. An official cost benefit review will be conducted prior to the implementations of any mitigation actions. Table 5-6 presents mitigation projects developed by the planning committee.

Table 5-6: Mitigation Strategies

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Priority	Comments
Harden the Remington Fire Station to withstand hazard effects	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Retrofit critical facilities with structural design practices and equipment that will withstand natural disasters and offer weather-proofing	Tornado, Thunderstorm, Earthquake	Remington	High	Local government and County EMA will oversee the implementation of this project. Funding has not been secured as of 2008, but the pre-disaster mitigation program and community development grants are a possible funding source. Implementation, if funding is available, is forecasted to be complete within approximately two years.
Bury power lines and/or trim trees surrounding power lines where necessary	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Equip public facilities and communities to guard against damage caused by secondary effects of hazards	Winter Storm, Tornado, Thunderstorm	Jasper County, Demotte, Remington, Rensselaer, Wheatfield	Medium	The County EMA, municipalities, and utility companies will oversee the implementation of this project. Local and corporate resources will be used to prioritize power lines and bury them. The project is forecasted to be complete within approximately three years.
Buy out properties located in flood-plain areas	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Minimize the amount of infrastructure exposed to hazards	Flood	Rensselaer (Austin St. and College Ave.), Remington (mobile park), Demotte (Begonia St.)	Low	The County EMA will oversee the implementation of this project. Local and corporate resources will be used to identify funding sources. Funding has not been secured as of 2008. Implementation, if funding is available, is forecasted to be complete within approximately five years.
Widen and improve the U.S. 24 bridge and the 231 bridge for better water drainage	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Minimize the amount of infrastructure exposed to hazards	Flood	Remington	Medium	The County EMA and municipalities will oversee the implementation of this project. Local and corporate resources will be used to secure funding. The project is forecasted to be complete within approximately three years.
Provide snow fencing on State Road 231 between 800 South and 1000 South	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Minimize the amount of infrastructure exposed to hazards	Winter Storm	Jasper County	Low	The County EMA will oversee the implementation of this project. Local resources as well as Indiana Department of Transportation will be used to secure funding. Funding has not been secured as of 2008, but the INDOT is a possible and logical funding source. Implementation, if funding is available, is forecasted to be complete within approximately five years.

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Priority	Comments
Implement an emergency weather alert on Channel 15 cable television	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county	All	Jasper County, Demotte, Remington, Rensselaer, Wheatfield	Low	The County EMA and local media will oversee the implementation of this project. Local resources will be used to determine possible sources of funding. Funding has not been secured as of 2008. Implementation, if funding is available, is forecasted to be complete within approximately five years.
Purchase and install warning sirens throughout the county	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Evaluate and strengthen the communication and transportation abilities of emergency services throughout the county	All	Jasper County, Demotte, Remington, Rensselaer, Wheatfield	Medium	The County EMA will oversee the implementation of this project. Local resources will be used to determine possible sources of funding. Funding has not been secured as of 2008. Implementation, if funding is available, is forecasted to be complete within approximately three years.
Develop a safe-house at the fairgrounds outside Rensselaer	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Improve emergency sheltering in Jasper County	All	Rensselaer	Low	The County EMA will oversee the implementation of this project. Local resources will be used to determine possible sources of funding. Funding has not been secured as of 2008. Implementation, if funding is available, is forecasted to be complete within approximately five years.
Construct safety shelters and cooling and heating structures throughout the county	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Improve emergency sheltering in Jasper County	All	Jasper County, Demotte, Remington, Rensselaer, Wheatfield	Low	The County EMA will oversee the implementation of this project. Local resources will be used to determine possible sources of funding. Funding has not been secured as of 2008. Implementation, if funding is available, is forecasted to be complete within approximately five years.
Dredge the Iroquois River through the Rensselaer area	**Goal:** Create new or revise existing plans/maps related to hazards affecting Jasper County **Objective:** Support compliance with the NFIP for each jurisdiction in Jasper County	Flood	Rensselaer	Low	The County EMA will oversee the implementation of this project. Local resources will be used to determine possible sources of funding. Funding has not been secured as of 2008. Implementation, if funding is available, is forecasted to be complete within approximately five years.
Review 1996 Cole Associates Study regarding buy-out plans for flood-prone areas	**Goal:** Create new or revise existing plans/maps related to hazards affecting Jasper County **Objective:** Review and update existing community studies, plans, and ordinances to support hazard mitigation	Flood	Jasper County, Demotte, Remington, Rensselaer, Wheatfield	Low	The County EMA will oversee the implementation of this project. Local resources will be used to determine possible sources of funding. Funding has not been secured as of 2008. Implementation, if funding is available, is forecasted to be complete within approximately five years.

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Priority	Comments
Perform watershed study coordinated with adjacent counties	**Goal:** Create new or revise existing plans/maps related to hazards affecting Jasper County **Objective:** Conduct new studies/research to profile hazards and follow up with mitigation strategies	Flood	Jasper County, Porter County, LaPorte County, Starke County, Pulaski County, White County, Benton County, Newton County, Lake County	Low	The County EMA will oversee the implementation of this project. Local resources will be used to determine possible sources of funding. Funding has not been secured as of 2008. Implementation, if funding is available, is forecasted to be complete within approximately five years.
Perform a study of the Austin Street area to determine the feasibility of a levee system	**Goal:** Create new or revise existing plans/maps related to hazards affecting Jasper County **Objective:** Conduct new studies/research to profile hazards and follow up with mitigation strategies	Flood	Rensselaer	Low	The County EMA will oversee the implementation of this project. Local resources will be used to determine possible sources of funding. Funding has not been secured as of 2008. Implementation, if funding is available, is forecasted to be complete within approximately five years.
Develop a database of individuals throughout the county who have specific medical problems	**Goal:** Create new or revise existing plans/maps related to hazards affecting Jasper County **Objective:** Conduct new studies/research to profile hazards and follow up with mitigation strategies	All	Jasper County, Demotte, Remington, Rensselaer, Wheatfield	Low	The County EMA in partnership with local government and medical facilities will oversee implementation of this project. Local resources will be used to determine funding. Funding has not been secured as of 2008. Implementation, if funding is available, is forecasted to be complete within approximately five years.
Develop a cell phone alert system similar to those recently implemented at various universities	**Goal:** Develop long-term strategies to educate the public on the hazards affecting Jasper County **Objective:** Raise public awareness	All	Jasper County, Demotte, Remington, Rensselaer, Wheatfield	Low	The County EMA in partnership with local schools and medical facilities will oversee implementation of this project. Local resources will be used to determine funding. Funding has not been secured as of 2008. Implementation, if funding is available, is forecasted to be complete within approximately five years.
Develop workshops and seminars and distribute literature to educate the general public on potential hazards	**Goal:** Develop long-term strategies to educate the public on the hazards affecting Jasper County **Objective:** Raise public awareness	All	Jasper County, Demotte, Remington, Rensselaer, Wheatfield	Low	The County EMA in partnership with local schools and medical facilities will oversee implementation of this project. Local resources will be used to determine funding. Funding has not been secured as of 2008. Implementation, if funding is available, is forecasted to be complete within approximately five years.

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Priority	Comments
Work with the Purdue Extension to educate the general public, especially farmers, regarding animal protection during hazards	**Goal:** Develop long-term strategies to educate the public on the hazards affecting Jasper County **Objective:** Raise public awareness	All	Jasper County, Demotte, Remington, Rensselaer, Wheatfield	Low	The County EMA in partnership with Purdue University will oversee implementation of this project. Local resources will be used to determine funding. Funding has not been secured as of 2008. Implementation, if funding is available, is forecasted to be complete within approximately five years.
Implement regular drills with schools and community members to test first responders' plans and familiarize the public with the roles of volunteers and citizens	**Goal:** Develop long-term strategies to educate the public on the hazards affecting Jasper County **Objective:** Raise public awareness	All	Jasper County, Demotte, Remington, Rensselaer, Wheatfield	Low	The County EMA in partnership with local school and social service agencies will oversee implementation of this project. Local resources will be used to determine funding. Funding has not been secured as of 2008. Implementation, if funding is available, is forecasted to be complete within approximately five years.
Provide training for LEPC members to educate them on identifying and responding to hazardous materials events	**Goal:** Develop long-term strategies to educate the public on the hazards affecting Jasper County **Objective:** Improve education of emergency personnel and public officials	Earthquake, HAZMAT	Jasper County, Demotte, Remington, Rensselaer, Wheatfield	High	The County EMA will oversee implementation of this strategy. Local resources will be used to determine funding. Funding has not been secured as of 2008. Implementation, if funding is available, is forecasted to be complete within approximately two years.
Evaluate the conditions under which a HAZMAT team could be developed for Jasper County	**Goal:** Develop long-term strategies to educate the public on the hazards affecting Jasper County **Objective:** Improve education of emergency personnel and public officials	HAZMAT	Jasper County, Demotte, Remington, Rensselaer, Wheatfield	Medium	The County EMA will oversee implementation of this strategy. Local resources will be used to determine funding. Funding has not been secured as of 2008. Implementation, if funding is available, is forecasted to be complete within approximately three years.
Construct a new fire station with a safe area for surrounding residents	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Retrofit critical facilities with structural design practices and equipment that will withstand natural disasters and offer weather-proofing	Tornado, Thunderstorm, Earthquake, Winter Storm	Wheatfield	High	The Town of Wheatfield will oversee implementation of this strategy. The project will begin at the design phase to include hazard mitigation measures for the Wheatfield residents. Funding has not been secured as of 2008. Implementation, if funding is available, is forecasted to be complete within approximately two years.

Mitigation Item	Goals and Objects Satisfied	Hazards Addressed	Jurisdictions Covered	Priority	Comments
Establish plan to clean up and re-design ditches	**Goal:** Create new or revise existing plans/maps related to hazards affecting Jasper County **Objective:** Support compliance with the NFIP for each jurisdiction in Jasper County	Flood	DeMotte, Wheatfield	Low	DeMotte and Wheatfield will oversee implementation of this project, potentially working with state agencies such as IDNR and INDOT. Funding has not been secured as of 2008, but local, state, and federal funding will be sought. Implementation, if funding is available, is forecasted to be complete within approximately five years.
Purchase generators for warming centers and shelters (DeMotte and Wheatfield fire stations, Town Halls, Legion Hall)	**Goal:** Lessen the impacts of hazards to new and existing infrastructure **Objective:** Improve emergency sheltering in Jasper County	Tornado, Thunderstorm, Earthquake, Winter Storm	DeMotte, Wheatfield	High	DeMotte and Wheatfield will oversee implementation of this project. Funding has not been secured as of 2008, but local resources are a possible source. Implementation, if funding is available, is forecasted to be complete within one year.

5.5 Multi-Jurisdictional Mitigation Strategy

The Jasper County Emergency Management will be the local champions for the mitigation actions. The county Commissioners and the City and Town councils will be an integral part of the implementation process. Federal and state assistance will be necessary for a number of the identified actions. Kankakee-Iroquois Regional Planning Commission is qualified to provide technical grant writing services to assist the county in seeking resources to achieve the recommended mitigation action.

As a part of the multi-hazard mitigation planning requirements at least two identifiable mitigation action items have been addressed for each hazard listed in the risk assessment and for each jurisdiction covered under this plan.

Section 6 – Plan Maintenance

6.1 Monitoring, Evaluating, and Updating the Plan

Throughout the five year planning cycle, the Jasper County EMA will reconvene the MHMP planning committee to monitor, evaluate, and update the plan on an annual basis. Additionally, a meeting will be held in the year 2013 to address the five-year update of this plan. Members of the planning committee are readily available to engage in email correspondence between annual meetings. If the need for a special meeting, due to new developments or a declared disaster occurs in the county, the team will meet to update mitigation strategies. Depending on grant opportunities and fiscal resources, mitigation projects may be implemented independently by individual communities or through local partnerships.

The committee will review the county goals and objectives to determine their relevance to changing situations in the county. In addition, state and federal policies will be reviewed to ensure they are addressing current and expected conditions. The committee will also review the risk assessment portion of the plan to determine if this information should be updated or modified. The parties responsible for the various implementation actions will report on the status of their projects, and will include which implementation processes worked well, any difficulties encountered, how coordination efforts are proceeding, and which strategies should be revised.

Updates or modifications to the MHMP during the five year planning process will require a public notice and a meeting prior to submitting revisions to the individual jurisdictions for approval. The plan will be updated via written changes, submissions as the committee deems appropriate and necessary, and as approved by the County Commissioners.

The GIS data used to prepare the plan was obtained from existing county GIS data as well as data collected as part of the planning process. This updated HAZUS-MH GIS data has been returned to the county for use and maintenance in the county's system. As newer data becomes available this updated data will be used for future risk assessments and vulnerability analyses.

6.2 Implementation through Existing Programs

The results of this plan will be incorporated into ongoing planning efforts. Many of the mitigation projects identified as part of this planning process are ongoing. If necessary, modifications will be made to the county and community planning documents and ordinances, listed in Table 6-1, as part of regular updates.

Table 6-1: Documents Impacted by the Pre-Disaster Mitigation Plan

Author(s)	Year	Title	Description
Jasper County Advisory Plan Commission	2002 (Updated April 23, 2008)	Jasper County, Indiana Zoning Code	Comprehensive plan for land use, transportation, and public facilities.
Town of Wheatfield	2008	Comprehensive Plan	Comprehensive plan for land use, transportation, and public facilities.

Author(s)	Year	Title	Description
Town of Wheatfield	1980 (updated 2000)	Wheatfield Zoning Code and Subdivision Control Code	Document describes the zoning within the jurisdiction of the Town of Wheatfield
Town of Remington	1994	Revised Zoning Code; Comprehensive Plan Code; Building Code	Documents describe the control of development within the jurisdiction of Remington.
Jasper County	2003	Comprehensive Emergency Management Plan	Document describes types of potential hazards, agencies involved in the response to an emergency as will as the organization to both respond and recover from an emergency
Jasper County	2003	Jasper County Emergency Management Ordinance, # 3-3-2003A	Document describes the authorization and responsibilities of the Emergency Management Agency
Town of Demotte	2006	Demotte Disaster Plan	Plan addresses emergency conditions in Demotte and surrounding areas; lists resources available within each jurisdiction

6.3 Continued Public Involvement

Continued public involvement is critical to the successful implementation of the MHMP. Comments from the public on the MHMP will be received by the Jasper County EMA Director and forwarded to the MHMP planning committee for discussion. Education efforts for hazard mitigation will be ongoing through the county website and through periodic EMA newsletters. For major mitigation issues, summaries will be posted on the county website, articles published in the local newspaper, and consideration given to a town hall meeting to invite public comments. Once adopted, a copy of this plan will be available in the county courthouse, in public libraries, and on the county website.